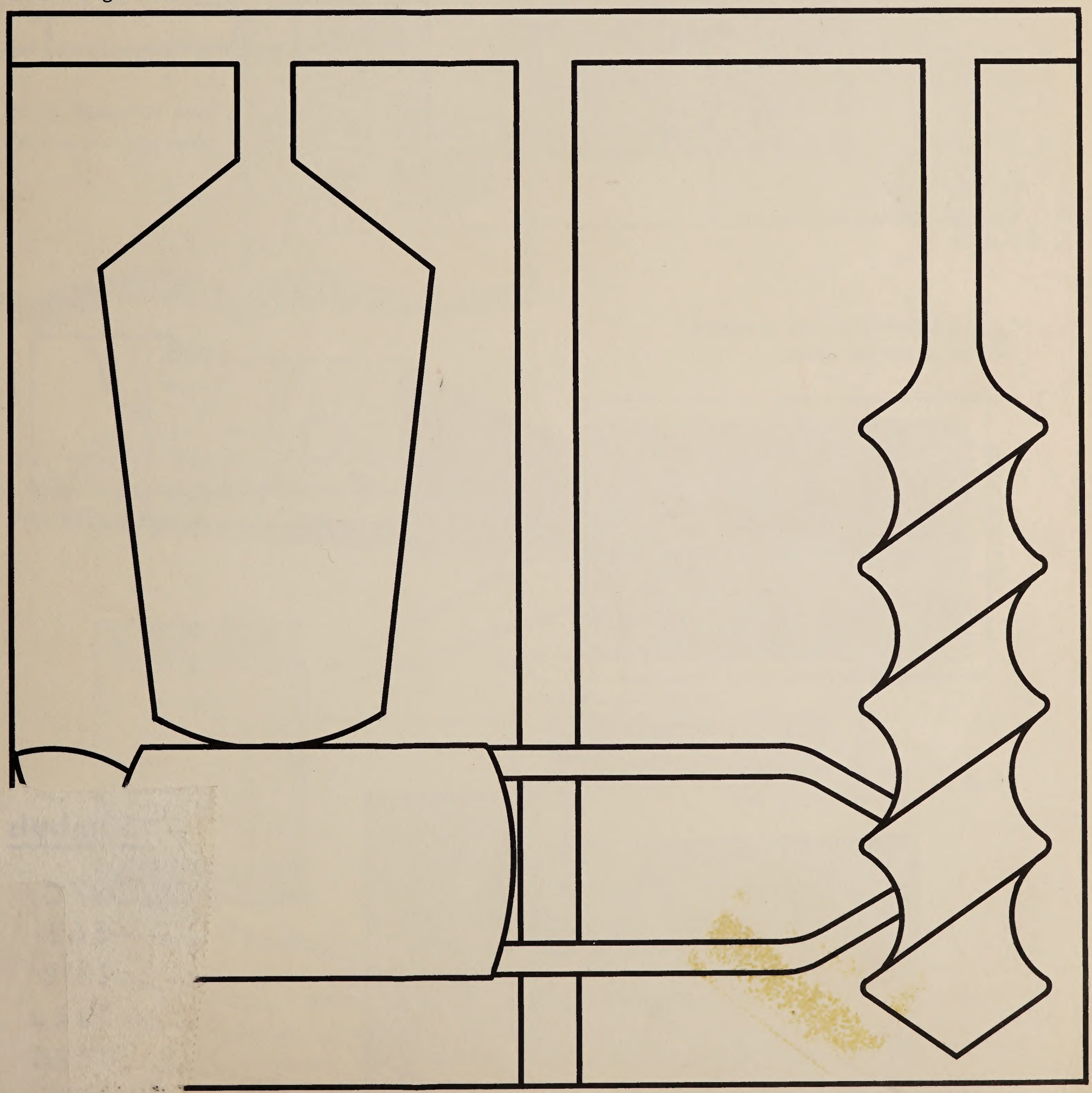
In cooperation with
Colorado Agricultural
Experiment Station

Soil Survey of Rio Blanco County Area Colorado

Soil
Conservation
Service

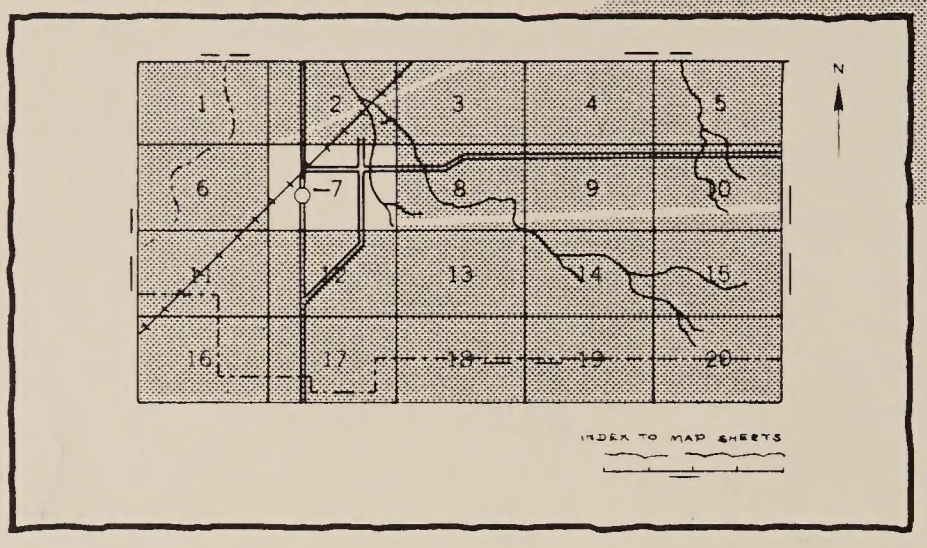
United States
Department of the
Interior

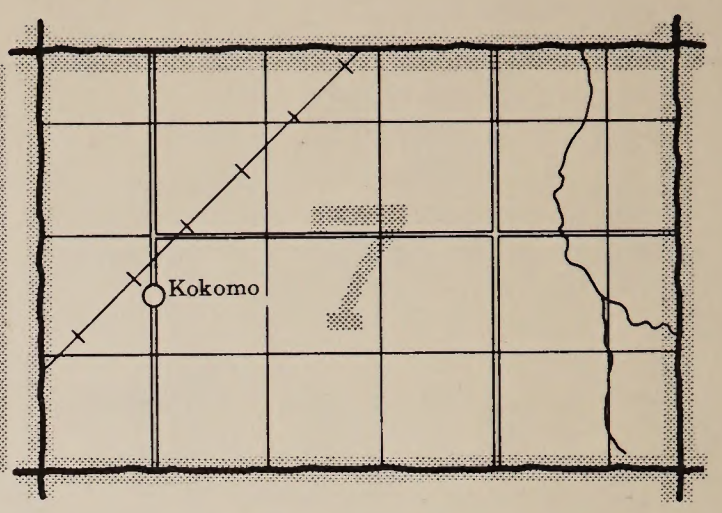
Bureau of
Land Management



HOW TO USE

1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).





2. Note the number of the map sheet and turn to that sheet.

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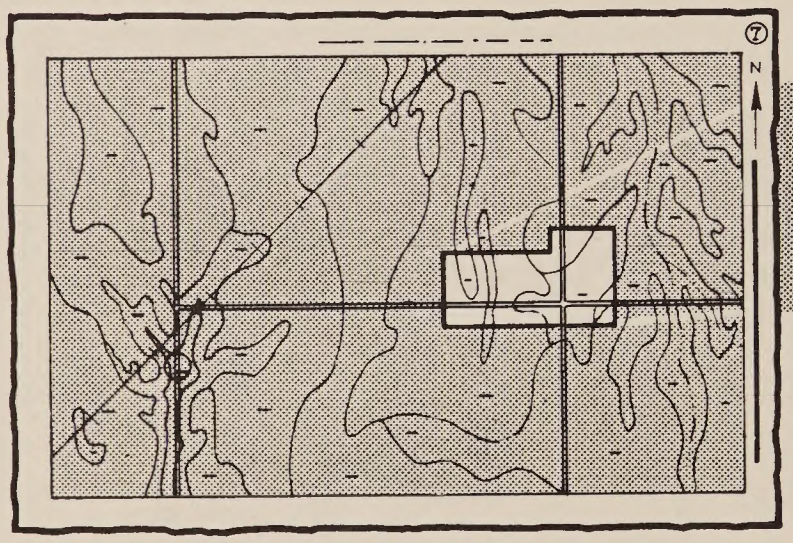
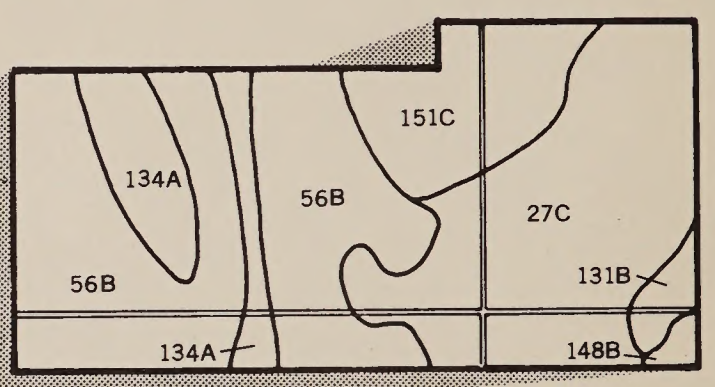
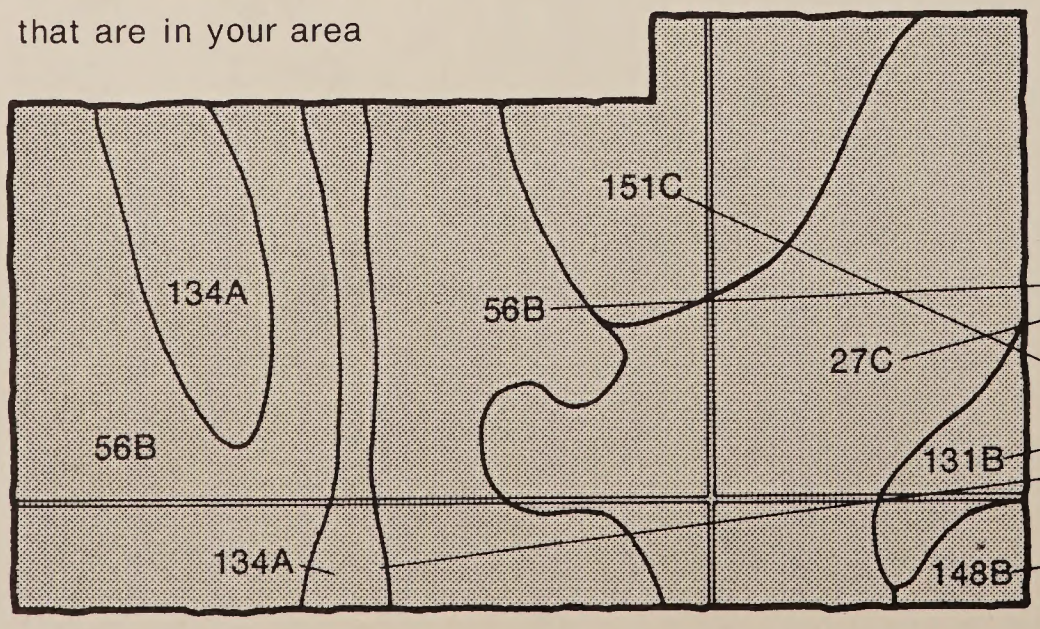




4. List the map unit symbols that are in your area



Symbols

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56B
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134A
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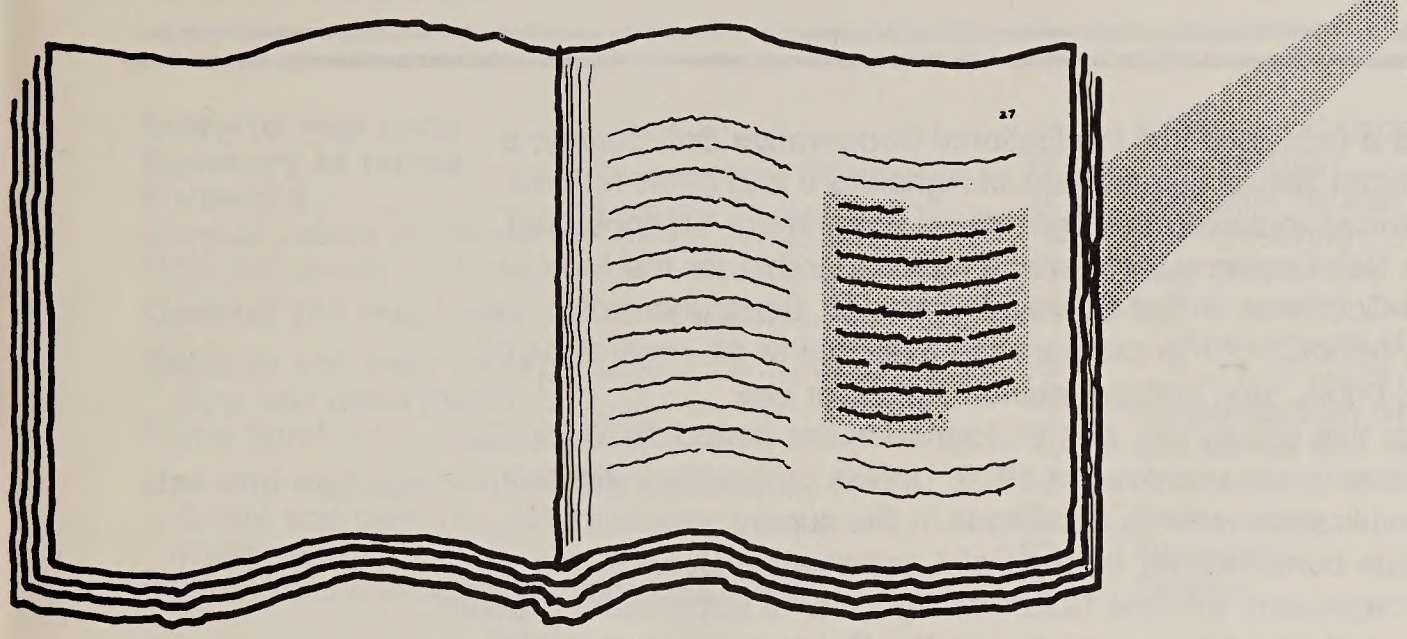
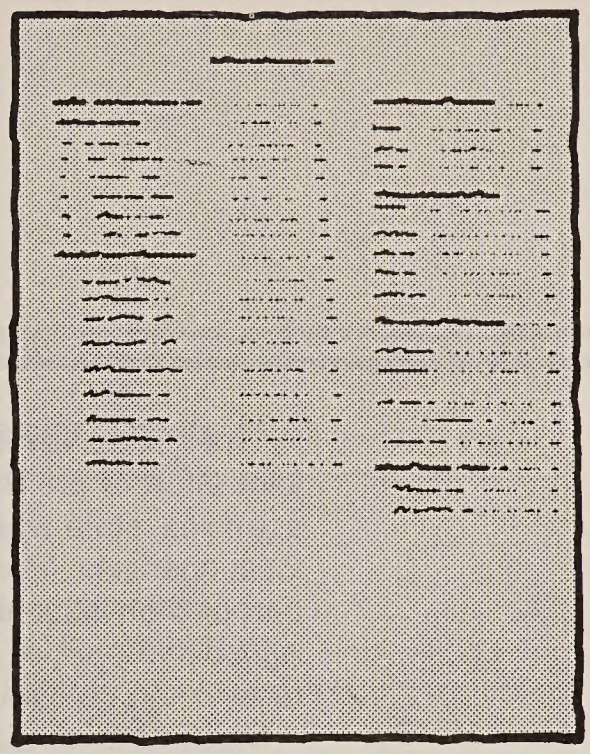
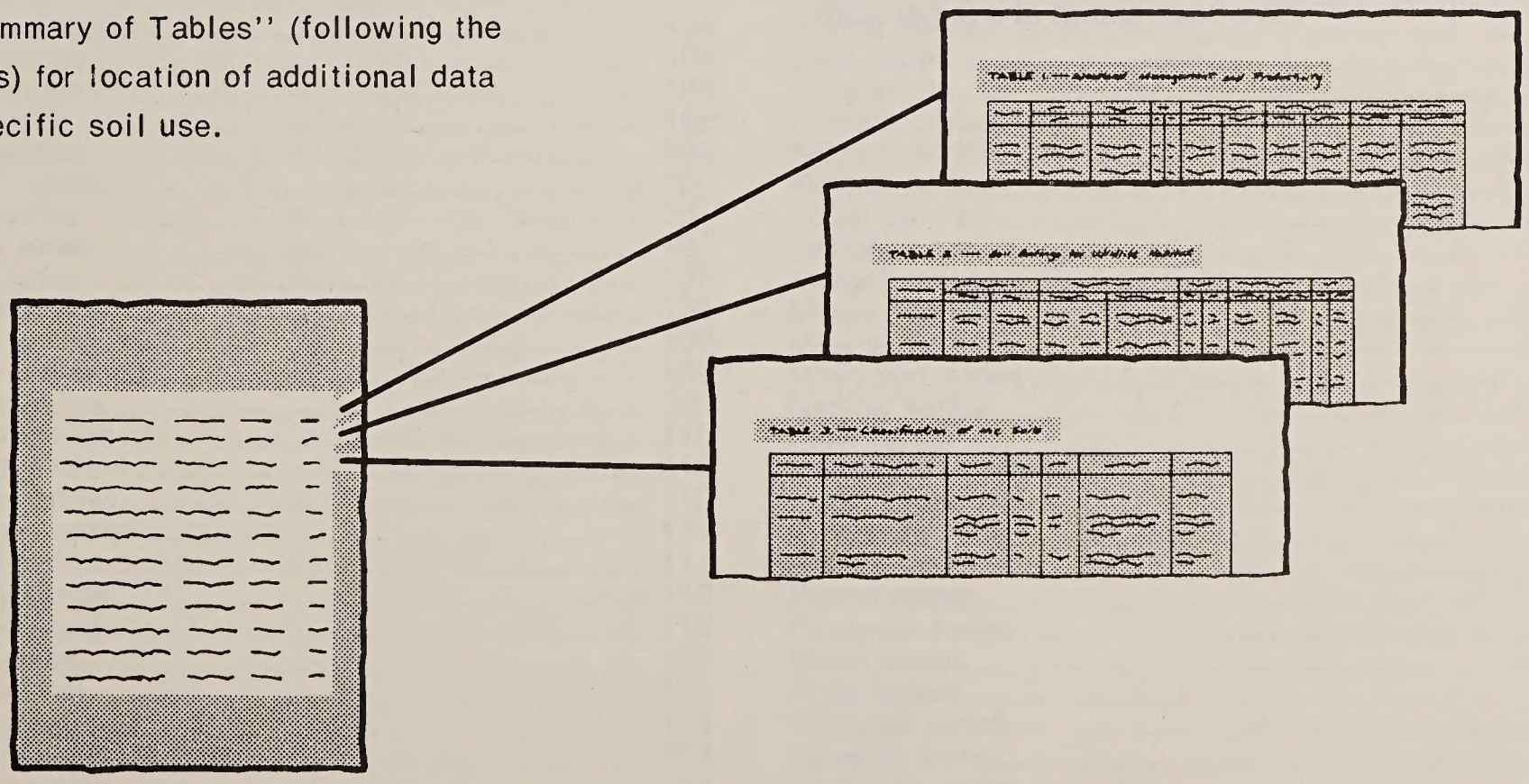
THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.





6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1970-79. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979. This survey was made cooperatively by the Soil Conservation Service, the Bureau of Land Management, and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the Douglas Creek and White River Soil Conservation Districts.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

contents

soil series

Issued May 1982

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summary of tables

foreword

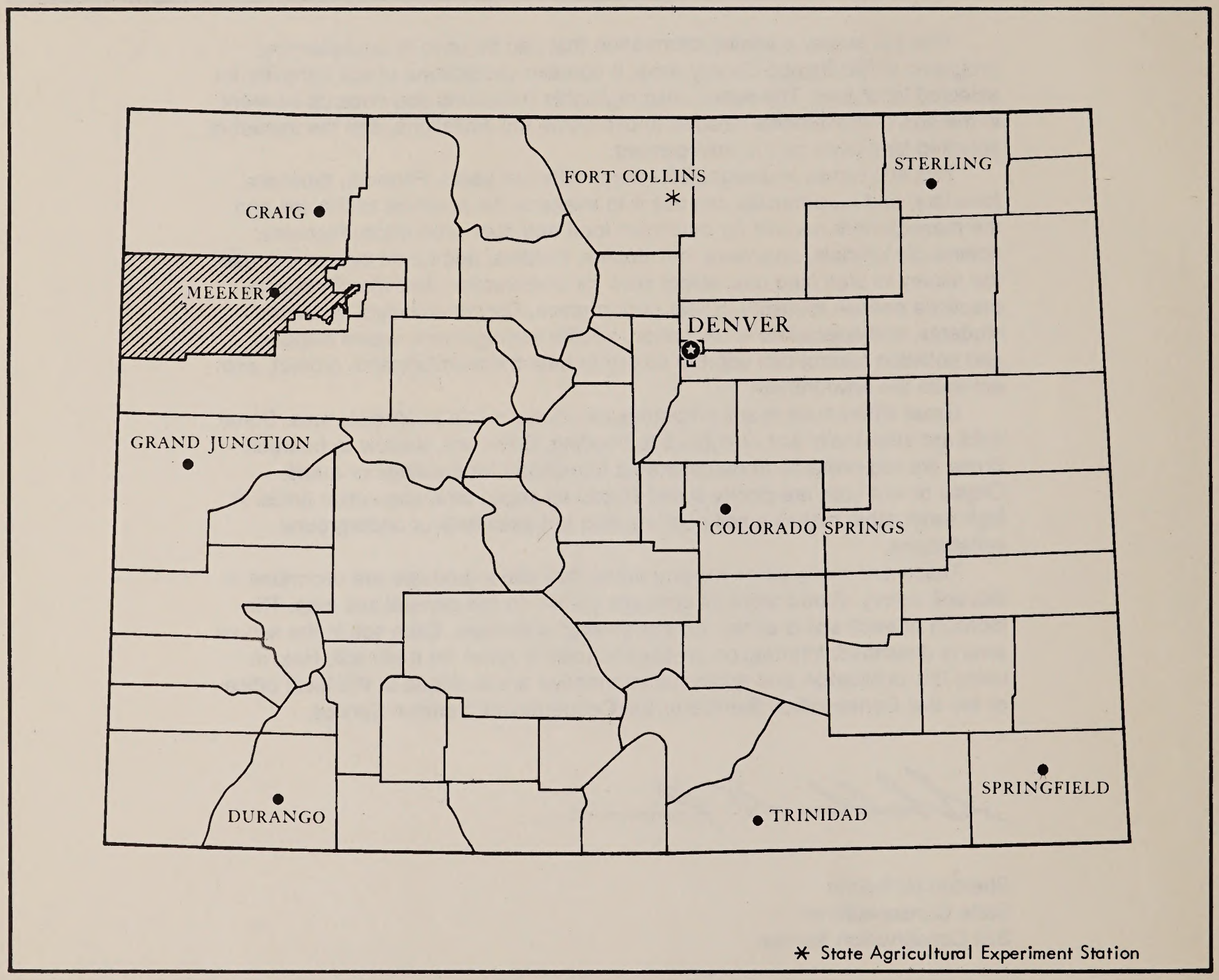
This soil survey contains information that can be used in land-planning programs in Rio Blanco County Area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Sheldon G. Boone
State Conservationist
Soil Conservation Service



Location of Rio Blanco County Area in Colorado.

soil survey of
Rio Blanco County Area, Colorado

By William P. Tripp, Leslie W. Williams, David K. Alstatt,
John J. Rawinski, and Clayton F. Spears, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, and
United States Department of the Interior, Bureau of Land Management,
in cooperation with Colorado Agricultural Experiment Station

RIO BLANCO COUNTY AREA is in the northwestern corner of Colorado. It has a total area of 1,693,700 acres, or about 2,646 square miles. Meeker is the county seat. Other communities in the area are Rangely, Buford, Rio Blanco, and White River City. The population of the area is about 5,350.

The survey area includes all of Rio Blanco County except for the part that is in the White River and Routt National Forests, at the far eastern end of the county. The Area is predominantly federally administered land. About 73 percent is administered by the United States Department of the Interior, Bureau of Land Management, and the United States Department of Agriculture, Forest Service. The state of Colorado administers 1.5 percent of the Area for wildlife and recreational uses. The White River flows westward through the Area. Its major tributaries are Big Beaver, Little Beaver, Coal, and Strawberry Creeks, which drain from the north, and Marvine, Elk, Miller, Piceance, Yellow, and Douglas Creeks, which drain from the south.

Elevation ranges from about 5,000 feet at the Utah state line to about 9,300 feet near Uranium Peak at the northeast edge of the Area and 9,650 feet on Buford Peak at the southeastern edge.

The climate of the survey area ranges from warm semidesert near the Utah state line to cool mediterranean in the low mountains and narrow valleys below the White River National Forest.

The Area is used mainly as rangeland. Raising cattle, sheep, and horses is important to the economy. The Area is also used as irrigated and nonirrigated cropland.

Two active oilfields are in the Area. One is in Rangely Basin, and the other is at the head of Wilson Creek, about 11 miles north of Meeker. Coal mining is being developed in two areas northeast of the towns of Rangely and Meeker. Two major oil shale development lease tracts are in the Piceance Basin. Natural gas has been developed throughout the western two-thirds of the Area, and explorations for uranium are being conducted north and east of Rangely and northeast of Meeker, below Uranium Peak.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey area.

general nature of the survey area

This section gives general information concerning the survey area. It discusses settlement and development; physiography, relief, and drainage; natural resources; water supply; agriculture; and climate.

settlement and development

Fathers Escalante and Domingues entered the survey area in 1776 on their way to California. They came down from the Roan Plateau to Douglas Creek and crossed the White River near what is now the town of Rangely. In 1844 Captain C. Fremont sailed down the White River, and in 1861 Captain E. I. Berthoud traveled along the White River seeking a more direct route from Salt Lake City to Denver. Major John Wesley Powell, his wife Emma, and about 20 survey students later came to the

White River Valley and established winter quarters in what is now Powell Park. In the 1880's people began to settle in the central and eastern parts of the survey area and near the town of Meeker. Rangely grew mainly during the oil boom in the 1940's.

Under the agricultural homestead laws, land suitable for crops on river bottoms, along drainageways, and on fertile rolling hills was patented in the late 1800's and early 1900's. Other land rich in minerals was developed and patented under the General Mining Law of 1872.

Cattle were brought to the Piceance Creek area about 1870 and to the area along White River about 1875. By 1885 cattle raising was important in the Rangely area. One ranch had about 1,000 head of cattle, and cattle grazed the open range year-round. In 1934 the Taylor Grazing Act was enacted, which virtually eliminated open range grazing.

About 10,000 head of sheep were brought into the survey area in December 1892. By the early 1920's, the sheep industry was fully established in the northeastern part of the area. Growth of the sheep industry brought many people to the Area (*6*).

Reverend Danforth was one of the first to use the survey area for farming. In 1875 he cultivated about 40 acres of potatoes, beets, and carrots. Production of field crops peaked before the Korean War. In 1944 there were 46 farms growing mainly field crops, but by 1959 there were only 10.

Dryfarming was successful only at elevations of less than 7,500 feet, in the eastern part of the survey area. Only forage crops were suitable for dryfarming above 7,500 feet. In 1930 forage production averaged more than 1 ton per acre, wheat production averaged 12 1/2 bushels per acre, and oat and barley production averaged about 20 bushels per acre (*15*). Yields have increased considerably in recent years, mainly because of the improved varieties of crops grown. Today more than 80 percent of the hay is irrigated, and there is a trend toward fewer acres of native hay.

The earliest appropriations of water rights for the White River were in 1880 and for Piceance Creek in 1883. Rights to water from most of the other creeks in the eastern half of the survey area were appropriated by 1888. In the drier western half of the area, water rights for Douglas Creek were appropriated in 1887 and for Evacuation and Missouri Creeks in 1903 to 1906.

Trapping in the survey area was begun about 1825, but by the 1840's the fur trade had diminished. This was partly because of a decrease in the beaver population and partly because of a decrease in demand.

In recent years several state highways have been built, making the survey area easily accessible for heavy truck transports from all directions. A major east-west interstate highway and the Denver-Rio Grande Railroad connect with the town of Rifle, which is only a few miles south of the survey area.

The first sawmill was built in the area in the early 1880's. A lime kiln was in operation by the early 1900's.

physiography, relief, and drainage

The survey area is in the far eastern part of the Colorado Plateau physiographic province and in the north-central part of the Southern Rocky Mountains physiographic province. The Grand Hogback in the eastern part of the Area divides these two broad provinces.

In the part of the Area in the Colorado Plateau physiographic province, the bedrock is mainly horizontal or only slightly tilted. This part consists largely of broad, dissected mesas and moderately rolling uplands (fig. 1). Some rock formations in this part of the Area do not have enough sandstone to form a protective cap; therefore, the landscape is more rugged. In the part of the Area in the Southern Rocky Mountains physiographic province, the bedrock commonly is more tilted and the landscape generally is rugged.

Valleys make up only a small part of the survey area. Valleys bordering the White River and its tributaries mostly are less than a mile wide. Wider valleys in the Meeker and Rangely areas mainly are the result of the erosion of soft shale.

Most of the survey area is drained by the White River and its tributaries. Streams in one small area in the far northeastern corner flow northerly and empty into the Yampa River. The White River originates east of the Area, in the Flat Tops Wilderness and near Trappers Lake. In the eastern part of the Area, the average annual precipitation is 16 inches or more, and many of the tributaries are perennial streams. These include the south fork of the White River and Marvine, Elk, Miller, Coal, Flag, and Strawberry Creeks. West of Strawberry Creek, the only perennial streams that reach the White River are Piceance, Yellow, Douglas, and Evacuation Creeks.

The Piceance Creek Basin is in the center of the survey area. It extends to Cathedral Bluffs in the west and to Grand Hogback in the east. The basin has broad structural topography, and it tilts gently toward the center.

The trellislike network of drainageways in the basin has produced rows of nearly parallel ridges and valleys that are oriented to the north and northeast. The ridges are relatively wide and convex and are gently sloping near the top. The lower part of the ridges is incised about 200 feet above the valley floor.

The central part of the Piceance Creek Basin is capped with calcareous sandstone and siltstone. Piceance and Yellow Creeks drain this area. Nearly vertical cliffs of hard, impermeable marlstone are at the rim of the basin, most prominently near Cathedral Bluffs.

West of Cathedral Bluffs and in the area north of the Piceance Creek Basin, the bedrock has less capping by

Figure 1.—View of the complex and highly dissected terrain typical of the part of the survey area in the Colorado Plateau physiographic province.

protective sandstone. Ridge crests generally are narrower, and in many places elevation varies as much as 800 feet. In this area the major drainageways are Douglas, Missouri, and Evacuation Creeks. Missouri and Evacuation Creeks join the White River in Utah.

Elevation in the survey area ranges from about 5,000 feet where the White River crosses the Utah state line to about 9,650 feet near the White River National Forest, at the eastern edge of the Area. Even the less steeply sloping areas near most of the creeks, gulches, and washes generally have gradients of more than 30 feet per mile. Some have gradients of more than 100 feet per mile. These and the steep and very steep gradients in extensive areas of shallow soils associated with watersheds result in scouring and rapid cutting of gullies.

natural resources

The Rio Blanco County Area has large amounts of natural resources such as oil, gas, coal, oil shale, and uranium.

Oil was first discovered near Wilson Creek (*4*). Oil exploration and production accelerated in the 1940's in the Rangely area, which prompted the rapid growth of Rangely.

Natural gas has been produced in the vicinity of Wilson Creek and Rangely since their establishment. Exploration for natural gas is rapidly increasing as energy demands increase (*7*).

The shortage of oil in the 1970's kindled new interest in the vast coal deposits in western Colorado. The old Rienau Coal Mine north of Meeker was expanded. Several new underground mines currently are being planned near Meeker and Rangely. Coal underlies approximately 27 percent of the survey area (*10*).

Active exploration and evaluation of oil shale began in the early 1970's. Vast oil shale deposits containing an estimated 1.25 trillion barrels of oil underlie the Piceance Basin area (*8*). In 1974 two federal leases of land rich in oil deposits were awarded to oil companies. Several other companies are planning oil shale development on private land.

Uranium prospecting and mining are conducted on a small scale in the area. The advent of nuclear power plants has spurred interest in uranium exploration.

The vast pinyon and juniper woodland in the survey area offers a popular alternative to the use of heating oil.

The demand for wood is rapidly increasing, and commercial firewood cutting is increasing each year.

Gravel is excavated from numerous pits throughout the survey area, generally along the river bottom and terraces. The thickness of these alluvial deposits and the quality of gravel vary greatly.

water supply

Nearly all of the survey area is drained by the White River and its tributaries; however, the far northeastern corner is drained by Milk and Wilson Creeks, which flow in a northerly direction to the Yampa River.

The White River receives most of its flow from the Flat Tops Mountains, which are outside the survey area in the White River National Forest. Only minor streams flow into the White River in the area between the confluence of the north and south forks of the river and the Utah state line, nearly 100 miles to the west.

Peak discharges into the streams normally are in May through early in July. On the average, nearly 50 percent of the discharge occurs in May and June.

During July, August, and September, the direct flow of the White River is inadequate to supply all of the water needs. Reservoir storage only partially compensates for this uneven flow of the river. Underground storage provides supplemental water in some areas.

Water quality is a product of numerous factors. Among these are the chemical, physical, and biologic constituents of the water. Water temperature also affects the quality of water for some uses, such as fishing. In the Piceance Creek Basin, water is stored in alluvium and generally is at a depth of 40 feet or less; however, it is also stored in two deeper aquifers. The deepest aquifer contains an estimated 25 million acre-feet of highly saline water, which is distributed over 630 square miles in the vicinity of Piceance and Yellow Creeks. Ground water in the rock aquifers is recharged by water moving down toward the center of the basin and is discharged through springs and seeps in the lower part of the principal stream valleys. The concentration of cations and anions in the water is strongly influenced by the amount of salt in the geologic layers (*14*).

Suspended particles such as clay and silt are more abundant in water during periods of rapid runoff, such as during rapid snowmelt or after high-intensity rainstorms. The amount of suspended solids that move into the streams is higher in the lower part of the watershed, where the climate is drier and there is less protective plant cover.

Snowmelt provides water of comparatively good quality. It is a source of water that is lower in content of salt than is the water provided by other sources, including wells. During periods of low streamflow, ground water seepage makes up a major part of the streamflow.

Calcium, magnesium, and sodium are among the more abundant dissolved constituents of water in the survey area. The most common anions are bicarbonate, sulphate, and chloride. Sodium and sulphate concentrations vary the most with streamflow and are higher in ground water seepage than in surface runoff. In most places, magnesium and sodium are the dominant cations in streamflow, and bicarbonate is the dominant anion.

From May through July, most of the flow of the White River comes from snowmelt and therefore is low in content of dissolved solids and high in content of sediment. From September through February, the concentration of dissolved solids increases and that of suspended solids decreases. This is the result of the change in the source of the flow from predominantly snowmelt to predominantly ground water.

The headwaters of the White River generally have a high concentration of salt, predominantly calcium bicarbonate. Artesian flow through abandoned exploration wells in the Meeker Dome oilfield results in the addition of approximately 160 tons of dissolved solids to the river each day (*9*). Piceance Creek adds about 38,000 tons of salt to the river yearly. All other streams entering the White River below Piceance Creek have a content of dissolved solids sufficient to affect the suitability of the water for drinking and for irrigating crops. In spite of the lower quality of the tributary water, the White River provides water that is suitable for irrigation and as habitat for fish.

Water near the edge of the basin is relatively low in content of dissolved solids, and the dominant ions are those of calcium, magnesium, and bicarbonate. Near the center of the basin, the water contains considerable amounts of dissolved saline mineral, and the principal constituents are sodium and bicarbonate.

In general, the area bordering Piceance Creek, from the mouth of Willow Creek, and Yellow Creek, from the mouth of Corral Creek, and extending to the White River Valley is very saline. Some of the water sources periodically have excessive amounts of lithium, barium, baron, and fluorine. In this area Douglas Creek has water of intermediate quality. Evacuation Creek, at a point a few miles across the Utah state line, has a concentration of dissolved solids about eight times that of the White River at a nearby point.

agriculture

By Alvin L. Jones, district conservationist, Soil Conservation Service.

Since the survey area was settled, raising cattle and sheep and growing wheat have been the mainstay of the local economy. The land along the White River, which was irrigated, provided winter and supplemental forage for livestock. Alfalfa and grass hay have been the main crops along the irrigated river bottoms and terraces. Barley, oats, and corn generally have been produced in lesser amounts. Some potatoes were grown west of Rangely in the earlier years. Irrigation was initiated in

1880 with the establishment of Powell Park Ditch. The principal irrigation ditches along the White River and its tributaries were constructed in the 1880's and 1890's.

Agriculture in the survey area today is diversified. It consists of growing irrigated pasture and hay, irrigated field crops, and nonirrigated field crops and raising sheep and cattle. This results in a fairly stable agricultural economy in the area. Approximately 4 percent of the survey area is irrigated cropland, about 1.6 percent is nonirrigated cropland, and about 61 percent is rangeland. The county is predominately federally administered land. About 73 percent of the total acreage is administered by the Bureau of Land Management and the Forest Service. The state of Colorado administers 1.5 percent of the county for wildlife and recreational uses.

The main nonirrigated crops are wheat and barley. Wheat usually is grown on about 60 percent of the nonirrigated cropland. This varies yearly depending on factors such as market conditions, soil moisture content, and climate. The majority of the wheat is planted every other year in fall under a wheat-fallow cropping system. The nonirrigated cropland is in the eastern half of Rio Blanco County.

The main irrigated crops are alfalfa and grass hay. Some oats are also grown, and approximately 200 acres of corn for silage is grown in the Rangely area. Most of the irrigation is done by contour ditch flooding; however, leveled land along the White River is irrigated by the border method. A few acres are irrigated by sprinkler systems.

Livestock enterprises are an important part of the agriculture in this survey area. Privately owned and federally administered rangeland provides grazing late in spring and in summer and provides winter range for sheep in the western part of the area. The livestock operations are primarily of the cow-calf and ewe-lamb type. A few operations depend entirely on raising yearlings.

Gradually, the number of farms and ranches is declining and the size of the individual units is increasing. The demand for agricultural land for other uses is also increasing.

The Douglas Creek Soil Conservation District was formed in 1945. It served the western third of the county. In 1946 two additional districts were organized in the eastern two-thirds of the county. They were the Lower White River and the Upper White River Soil Conservation Districts. In 1964 these two districts were consolidated into the White River Soil Conservation District.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

In the Rio Blanco County Area, summers are warm or hot in most valleys but are much cooler in the mountains. Winters are cold in the mountains. The valleys are colder than the lower slopes of adjacent mountains because of cold air drainage. Precipitation occurs in the mountains throughout the year, and a deep snowpack accumulates in winter. Snowmelt usually supplies much more water than can be used for agriculture in the survey area. In the valleys, precipitation in summer falls as showers and some thunderstorms. In winter the ground is covered with snow much of the time. Chinook winds, which blow downslope and are warm and dry, often melt and evaporate the snow.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Rangely, Meeker, and Little Hills, Colorado, for the period 1951 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season. These tables show the climatic variability among various localities at different elevations in the area.

In winter, the average temperature is 20 to 24 degrees F and the average daily minimum is 5 to 10 degrees. The lowest temperature on record, -48 degrees, occurred at Little Hills on January 12, 1963. In summer, the average temperature is 63 to 69 degrees and the average daily maximum is 83 to 88 degrees. The highest temperature, 108 degrees, was recorded at Rangely on June 21, 1974.

Growing degree days, shown in table 1, are equivalent to "heat units." Beginning in spring, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 55 percent usually falls during the period April through September, which includes the growing season for most crops. Two years in ten, the rainfall in April through September is less than 5.17 inches. The heaviest 1-day rainfall during the period of record was 2.00 inches at Rangely on June 10, 1970. About 35 thunderstorms occur each year, 21 of which are in summer.

Average seasonal snowfall is 40 to 80 inches. The greatest snow depth at any one time during the period of record was 30 inches. On an average of 15 to 30 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is less than 33 percent in spring and is about 44 percent the rest of the year. Humidity is higher at night year-round, and the average at dawn is about 59 percent. The sun shines 77 percent of the time possible in summer and 61 percent in winter. The prevailing wind is from the east-southeast. Average windspeed is highest, 10 miles per hour, in June.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The 12 map units in this survey have been grouped into four general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

soils on flood plains, terraces, alluvial valley floors, fans, and valley side slopes

This group consists of three map units. It makes up about 9.5 percent of the survey area. The soils in this group are nearly level to moderately steep. The native vegetation is mainly willows, shrubs, and grasses. Some trees are along major streams. Elevation is 5,000 to 7,200 feet. The average annual precipitation is about 8 to 20 inches, the average air temperature is 37 to 54 degrees F, and the average frost-free season is 70 to 130 days.

The soils in this group are deep and are well drained and moderately well drained. They formed in mixed alluvium derived dominantly from sedimentary rock.

This group is used mainly for irrigated hay and pasture and as rangeland. It is also used for wildlife habitat.

1. Billings-Uffens-Colorow

Deep, well drained and moderately well drained, nearly level to sloping soils

This map unit is along streams in the western part of the survey area. It is mainly on flood plains, terraces, alluvial valley floors, and fans. Slope is 0 to 5 percent. The vegetation on this unit is mainly shrubs and grasses. Some cottonwood trees and willows are along the major streams. Elevation is 5,100 to 5,800 feet. The average annual precipitation is about 8 to 14 inches, the average air temperature is 48 to 54 degrees F, and the average frost-free season is 105 to 130 days.

This unit makes up about 1.5 percent of the survey area. It is about 33 percent Billings soils, 17 percent Uffens soils, and 14 percent Colorow soils. The remaining 36 percent is components of minor extent.

Billings soils are nearly level to sloping. They are on stream terraces and alluvial valley floors. These soils are deep and well drained. They formed in silty alluvium derived dominantly from shale. The soils are moderately fine textured throughout. They commonly are slightly affected by salt and alkali.

Uffens soils are nearly level to undulating. They are on stream terraces and broad fans. These soils are deep and well drained. They formed in alluvium. The soils are medium textured throughout. They are strongly affected by salt and alkali.

Colorow soils are nearly level and gently sloping. They are on alluvial valley floors, flood plains, fans, and low terraces. These soils are deep and moderately well drained. They formed in mixed alluvium derived dominantly from sandstone. The soils are stratified and, on the average, are moderately coarse textured.

Of minor extent in this unit are Fluvaquents, Clifterson soils, and Torrifluvents.

Most areas of this unit are used for irrigated hay and pasture and as rangeland. A few areas are used for cultivated ensilage crops.

If this unit is used for irrigated hay and pasture or ensilage crops, the main limitations are the slight salinity and slow permeability of the Billing soils and the strong salinity of the Uffens soils.

This unit provides habitat for rangeland wildlife such as antelope, mule deer, cottontail, jackrabbit, raccoon, bobcat, and coyote. Areas planted to crops provide additional feed. Waterfowl inhabit the river bottom and oxbows along the White River. Small areas of wetland plants on the Colorow soils provide nesting areas and protective cover.

This unit is poorly suited to urban development. The main limitations are the hazard of flooding and shrink-swell potential.

2. Glendive-Kobar-Havre

Deep, well drained, nearly level to moderately steep soils

This map unit is along drainageways in the eastern part of the survey area. It is mainly on fans, stream terraces, alluvial valley floors, flood plains, and valley side slopes. Slope is 0 to 15 percent. The vegetation on this unit is mainly grasses and shrubs. Some sedges, willows, and narrowleaf cottonwood trees are along perennial streams. Elevation is 5,800 to 7,200 feet. The average annual precipitation is about 14 to 20 inches, the average air temperature is 40 to 46 degrees F, and the average frost-free season is 70 to 105 days.

This unit makes up about 7 percent of the survey area. It is about 28 percent Glendive soils, 16 percent Kobar soils, and 14 percent Havre soils. The remaining 42 percent is components of minor extent.

Glendive soils are gently sloping. They are on alluvial valley floors. These soils are deep and well drained. They formed in alluvium. The soils are moderately coarse textured throughout. They are droughty and are slightly affected by salt and alkali in some small areas.

Kobar soils are nearly level to moderately steep. They are on fans and valley side slopes. These soils are deep and well drained. They formed in alluvium derived dominantly from shale. The soils are fine textured and calcareous throughout. They are slightly to moderately affected by salt and alkali.

Havre soils are gently sloping. They are on low stream terraces and on flood plains. These soils are deep and well drained. They formed in alluvium. The soils are stratified and, on the average, are medium textured. They generally are calcareous throughout and are slightly affected by salt and alkali in some places.

Of minor extent in this unit are Absher, Barcus, Dollard, Redrob, Shawa, and Tisworth soils.

This unit is used mainly for irrigated hay and pasture. It is also used for livestock grazing and wildlife habitat.

If this unit is used for hay and pasture or grazing, the main limitations are a lack of irrigation water in many areas, a short growing season, moderately saline areas, and the slow permeability of the Kobar soils.

This unit provides habitat for rangeland wildlife such as elk, mule deer, cottontail, jackrabbit, raccoon, muskrat, bobcat, and coyote. It also provides winter habitat for bald eagles. Areas that are cultivated provide additional food. Waterfowl inhabit the river bottoms and oxbows along the channels of Piceance Creek and White River. Small areas of wetland plants provide nesting areas and protective cover.

This unit is poorly suited to homesite development. The main limitations are flood hazard, shrink-swell potential, wetness, and a seasonal high water table.

soils on uplands and desert foothills

This group consists of two map units. It makes up about 3.5 percent of the survey area. The soils in this group are gently sloping to steep. The native vegetation is mainly low salt tolerant and other low desert shrubs and sparse grasses. Elevation is 5,000 to 6,000 feet. The average annual precipitation is about 8 to 13 inches, the average air temperature is 47 t0 54 degrees F, and the average frost-free season is 105 to 130 days.

The soils in this group are shallow to deep and are well drained and somewhat excessively drained. They formed in alluvium, colluvium, residuum, and reworked eolian deposits derived dominantly from shale and sandstone.

This group is used mainly for livestock grazing and wildlife habitat.

3. Turley-Cliffdown-Kinnear

Deep, well drained and somewhat excessively drained, nearly level to sloping soils

This map unit is in the northwestern corner of the survey area. It is mainly on uplands, fans, terraces, and alluvial valley floors. Slope is 0 to 8 percent. The vegetation on this unit is mainly low desert shrubs and grasses. Elevation is 5,000 to 5,800 feet. The average annual precipitation is about 8 to 12 inches, the average air temperature is 50 to 54 degrees F, and the average frost-free season is 105 to 130 days.

This unit makes up about 1 percent of the survey area. It is about 58 percent Turley soils, 17 percent Cliffdown soils, and 12 percent Kinnear soils. The remaining 13 percent is components of minor extent.

Turley soils are nearly level to gently sloping. They are on alluvial valley floors, fans, and low terraces. These soils are deep and well drained. They formed in calcareous alluvium. The soils are medium textured. They commonly are slightly affected by salt and alkali.

Cliffdown soils are sloping. They are on side slopes of terraces. These soils are deep and somewhat excessively drained. They formed in mixed alluvium. The soils are very gravelly and are moderately coarse textured. They are slightly affected by salt and alkali in some places.

Kinnear soils are gently sloping. They are on uplands, fans, and terraces. These soils are deep and well drained. They formed in eolian fine sand and alluvium. The soils are medium textured.

Of minor extent in this unit are Cliffdown Variant, Moyerson, Nihill, Rentsac, and Uffens soils. Also included are small areas of Rock outcrop.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used as irrigated cropland. Some areas are also used for urban development.

If this unit is used as irrigated cropland, the main limitations are the salt- and alkali-affected areas. The main limitations for homesite development are the short, steep slopes and the hazard of seepage. The Cliffdown soils are also used as a source of roadfill and gravel.

This unit provides habitat for rangeland wildlife such as antelope, mule deer, cottontail, jackrabbit, bobcat, coyote, and prairie dog. Areas planted to crops provide additional feed.

4. Chipeta-Killpack

Shallow and moderately deep, well drained, gently sloping to steep soils

This map unit is in the northwestern part of the survey area and along the northern boundary, north of the town of Rangely. It is mainly on low hills, ridges, and toe slopes. Slope is 3 to 25 percent. The vegetation on this unit is mainly salt-tolerant desert shrubs and sparse grasses. Elevation is 5,100 to 6,000 feet. The average annual precipitation is about 8 to 10 inches, the average annual air temperature is 48 to 52 degrees F, and the average frost-free season is 105 to 130 days.

This unit makes up about 2 percent of the survey area. It is about 68 percent Chipeta soils and 10 percent Killpack soils (fig.2).

Chipeta soils are undulating to steep. They are on low hills and ridges. These soils are shallow and well drained. They formed in residuum derived from gypsiferous shale. The soils are fine textured. They are moderately to strongly affected by salt and alkali.

Killpack soils are gently sloping to sloping. They are on toe slopes of low hills and ridges. These soils are moderately deep and well drained. They formed in residuum and colluvium derived from gypsiferous shale. The soils are moderately fine textured. They are moderately to strongly affected by salt and alkali.

Of minor extent in this unit are Billings, Nihill, and Turley soils and gullied Torrifluvents. In some areas these soils are severely eroded.

This unit is used mainly for wildlife habitat. Some areas are used for livestock grazing. A few areas are also used for oil and natural gas production.

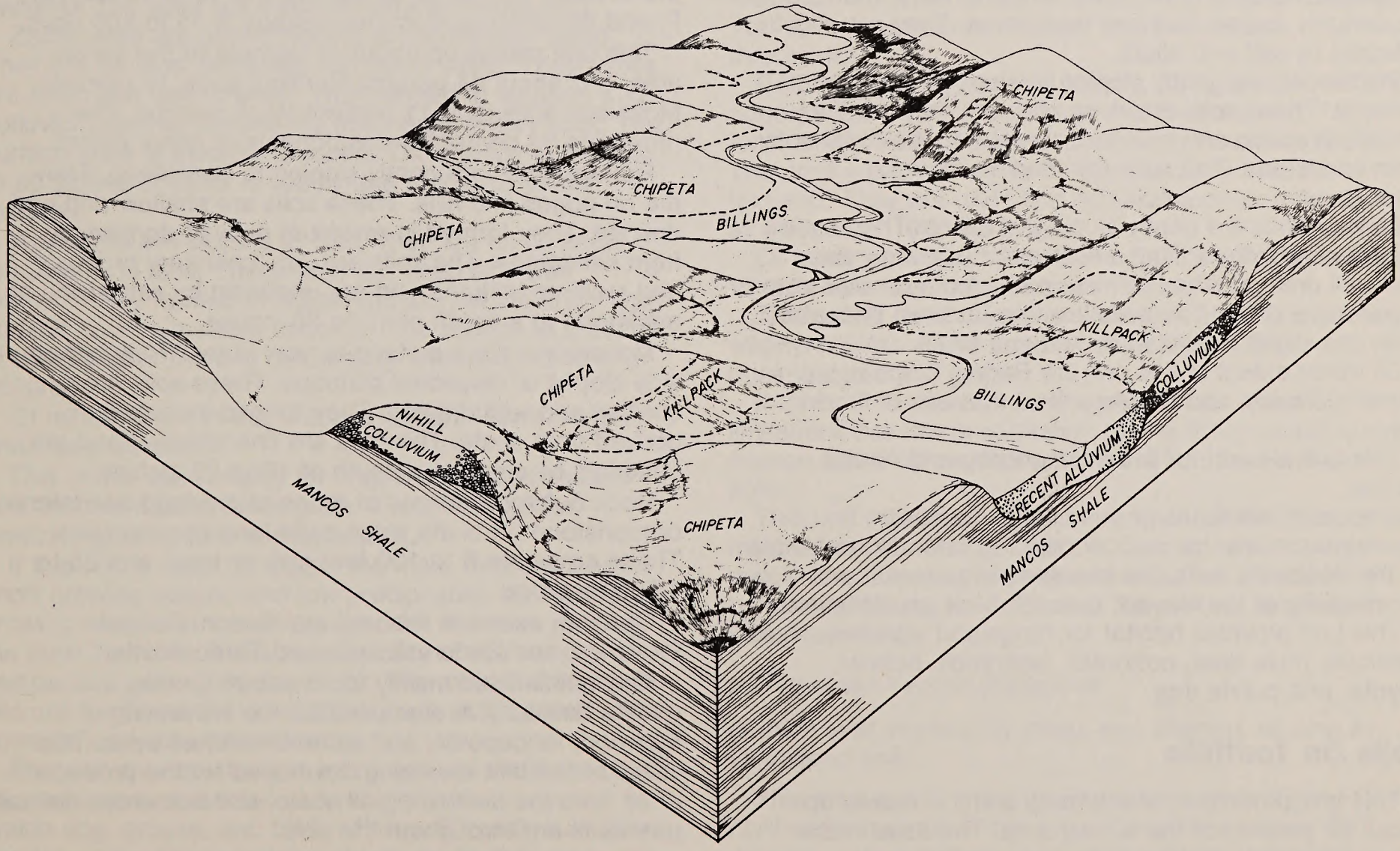


Figure 2.—Typical pattern of soils in general map unit 4.

This unit is poorly suited to most uses. The main limitations are shallow depth to bedrock, a high hazard of erosion, slow permeability, and shrink-swell potential.

This unit provides habitat for rangeland wildlife such as antelope, jackrabbit, bobcat, and coyote.

5. Walknolls-Potts-Gaynor

Shallow to deep, well drained, gently sloping to steep soils

This map unit is in the western part of the survey area, along the Utah-Colorado state line. It is mainly on low hills, ridges, and uplands. Slope is 2 to 50 percent. The vegetation on this unit is mainly salt-tolerant and other desert shrubs and grasses. Elevation is 5,200 to 6,000 feet. The average annual precipitation is about 8 to 12 inches, the average annual air temperature is 48 to 54 degrees F, and the average frost-free season is 105 to 130 days.

This unit makes up about 1.5 percent of the survey area. It is about 29 percent Walknolls soils, 20 percent Potts soils, and 16 percent Gaynor soils. The remaining 35 percent is components of minor extent.

Walknolls soils are sloping to steep. They are on low hills and ridges. These soils are shallow and well drained. They formed in residuum derived dominantly from sandstone. The soils are very channery and moderately coarse textured throughout. They are slightly affected by salt and alkali.

Potts soils are gently sloping to sloping. They are on uplands. These soils are deep and well drained. They formed in eolian and alluvial material derived dominantly from sandstone. The soils are medium textured throughout.

Gaynor soils are gently sloping to rolling. They are on low hills and ridges. These soils are moderately deep and well drained. They formed in residuum derived from gypsiferous shale. The soils are fine textured throughout. They are slightly affected by salt and alkali.

Of minor extent in this unit are Begay, Chipeta, Glenton, Turley, and Uffens soils and areas of Rock outcrop.

This unit is used for livestock grazing and wildlife habitat.

The main limitations of this unit for homesite development are the shallow depth to bedrock and slope of the Walknolls soils, the shrink-swell potential and slow permeability of the Gaynor soils, and low precipitation.

This unit provides habitat for rangeland wildlife such as antelope, mule deer, cottontail, jackrabbit, bobcat, coyote, and prairie dog.

soils on foothills

This group consists of four map units. It makes up about 67 percent of the survey area. The soils in this group are gently sloping to very steep. The native vegetation is mainly pinyon, juniper, mountain brush, sagebrush, and grasses. Elevation is 5,300 to 8,000 feet. The average annual precipitation is about 14 to 18 inches, the average air temperature is 44 to 48 degrees F, and the average frost-free season is 75 to 105 days.

The soils in this group are shallow to deep and are well drained. They formed in residuum, colluvium, alluvium, and eolian material derived dominantly from sedimentary rock.

This group is used mainly for livestock grazing and wildlife habitat. It is also used for the harvesting of firewood, fenceposts, and Christmas trees and for the development of shale oil and natural gas production.

6. Rentsac-Moyerson-Rock outcrop

Shallow, well drained, gently sloping to very steep soils, and Rock outcrop

This map unit is throughout the survey area. It is mainly on foothills and uplands that are highly entrenched by numerous narrow valleys and canyons that have steep side slopes, bluffs, and narrow ridges. Slope is 2 to 90 percent. The vegetation on this unit is mainly pinyon and juniper and a sparse understory of shrubs and grasses. Elevation is 5,300 to 7,600 feet. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free season is 75 to 105 days.

This unit makes up about 49 percent of the survey area. It is about 44 percent Rentsac soils, 14 percent Moyerson soils, and 11 percent Rock outcrop. The remaining 31 percent is components of minor extent.

Rentsac soils are gently sloping to very steep. They are on ridges and hills. These soils are shallow and well drained. They formed in residuum derived dominantly from sandstone. The soils are very channery or flaggy and medium textured and are underlain by sandstone or marlstone at a depth of 10 to 20 inches.

Moyerson soils are steep to very steep. They are on side slopes of dissected plateaus. These soils are shallow and well drained. They formed in residuum derived from shale. The soils are fine textured and are underlain by shale at a depth of 10 to 20 inches.

Rock outcrop consists of areas of exposed sandstone or marlstone on bluffs, ridge caps, and canyon walls. These areas are 5 to 100 feet high or more and 25 to 1,500 feet long.

Of minor extent in this unit are Blazon, Dollard, Piceance, and Redcreek soils and Torriorthents.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for the harvesting of firewood, fenceposts, and some Christmas trees. Two areas of the unit are being developed for the production of oil from the underlying oil shale, and numerous natural gas wells are throughout the unit.

The main limitations of this unit for most uses are shallow depth to bedrock, the hazard of erosion,

steepness of slope, and the areas of Rock outcrop, which restrict accessibility.

This unit provides habitat for rangeland wildlife such as mule deer, cottontail, jackrabbit, bobcat, coyote, grouse, birds of prey, and wild horses. It also provides habitat for some elk during severe winters.

7. Forelle-Zoltay-Work

Deep, well drained, gently sloping to hilly soils

This map unit is mainly in the eastern part of the survey area. It is mainly on uplands, terraces, fans, and valley sides. Slope is 1 to 25 percent. The vegetation on this unit is mainly sagebrush and some patches of Gamble oak, serviceberry and other low shrubs, and mixed grasses. Elevation is 5,800 to 8,000 feet. The average annual precipitation is about 15 to 18 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free season is 75 to 105 days.

This unit makes up about 3 percent of the survey area. It is about 40 percent Forelle soils, 33 percent Zoltay soils, and 19 percent Work soils. The remaining 8 percent is components of minor extent .

Forelle soils are gently sloping to moderately steep. They are on uplands and terraces. These soils are deep and well drained. They formed in eolian and alluvial material. The soils are medium textured throughout.

Zoltay soils are gently sloping to moderately steep. They are on fans, terraces, and valley sides. These soils are deep and well drained. They formed in alluvium and colluvium derived dominantly from sedimentary rock. The surface layer is medium textured. The subsoil to a depth of 60 inches or more is cobbly and moderately fine textured.

Work soils are sloping to hilly. They are on uplands, terraces, and fans. These soils are deep and well drained. They formed in eolian and alluvial material. The surface layer is medium textured. The subsoil to a depth of 60 inches or more is moderately fine textured to fine textured.

Of minor extent in this unit are Guben, Havre, Patent, and Piceance soils.

This unit is used mainly for irrigated hay and pasture and for nonirrigated small grain. It is also used for livestock grazing and wildlife habitat.

If this unit is used for crops, the main limitations are a short growing season and low precipitation during the growing season. If the unit is used for livestock grazing, the main limitation is the susceptibility of the soils to compaction when they are moist. The main limitations of this unit for homesite development are shrink-swell potential and slow permeability.

This unit provides habitat for rangeland wildlife such as elk, mule deer, cottontail, jackrabbit, bobcat, coyote, prairie dog, grouse, and birds of prey. Elk and mule deer use the unit mainly as winter range. Areas that are cultivated provide additional food.

8. Piceance-Yamac-Rentsac

Shallow to deep, well drained, gently sloping to hilly soils

This map unit extends from northwest of the town of Meeker through Piceance Creek Basin to the west-central part of the survey area. It is mainly on uplands, fans, hills, and ridges. Slope is 2 to 30 percent. The vegetation on this unit is mainly sagebrush and other low shrubs and mixed grasses. Thin stands of pinyon and juniper are on the Rentsac soils. Elevation is 5,800 to 7,600 feet. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free season is 75 to 105 days.

This unit makes up about 4 percent of the survey area. It is about 35 percent Piceance soils, 24 percent Yamac soils, and 21 percent Rentsac soils. The remaining 20 percent is components of minor extent.

Piceance soils are gently sloping to rolling. They are on uplands and ridgetops. These soils are moderately deep and well drained. They formed in eolian and colluvial material derived dominantly from sandstone. The soils are medium textured and are underlain by sandstone at a depth of 20 to 40 inches.

Yamac soils are gently sloping to moderately steep. They are on uplands and fans. These soils are deep and well drained. They formed in eolian and alluvial material. The soils are medium textured and calcareous throughout.

Rentsac soils are sloping to hilly. They are on hills and ridges. These soils are shallow and well drained. They formed in residuum derived dominantly from sandstone. The soils are channery and flaggy and are medium textured. They are underlain by sandstone or marlstone at a depth of 10 to 20 inches.

Of minor extent in this unit are Castner, Redcreek, and Veatch soils, Torriorthents, and Rock outcrop.

This unit is used mainly for livestock grazing and wildlife habitat. A few small areas are used for nonirrigated small grain.

If this unit is used for nonirrigated crops, the main limitations are low precipitation during the growing season and shallow depth to bedrock in the Rentsac soils.

This unit provides habitat for rangeland wildlife such as mule deer, cottontail, jackrabbit, bobcat, coyote, prairie dog, birds of prey, and grouse. Areas that are cultivated provide additional food. Elk use this unit as range during severe winters.

9. Castner-Veatch-Redcreek

Shallow and moderately deep, well drained, sloping to very steep soils

This map unit is in the southwestern, central, and northeastern parts of the survey area. It is mainly on uplands, mountainsides, and ridges. Slope is 5 to 50 percent. The vegetation on this unit is mainly mountain

brush and shrubs. Some grasses are on the Castner and Veatch soils, and pinyon and juniper are on the Redcreek soils. Elevaton is 6,000 to 7,400 feet. The average annual precipitation is about 14 to 18 inches, the average annual air temperature is 40 to 46 degrees F, and the average frost-free season is 75 to 105 days.

This unit makes up about 11 percent of the survey area. It is about 32 percent Castner soils, 13 percent Veatch soils, and 13 percent Redcreek soils. The remaining 42 percent is components of minor extent.

Castner soils are sloping to very steep. They are on uplands, mountainsides, and ridgetops. These soils are shallow and well drained. They formed in residuum derived dominantly from sandstone. The soils are channery and very channery and are medium textured. They are underlain by sandstone or marlstone at a depth of 10 to 20 inches.

Veatch soils are moderately steep to steep. They are on mountainsides. These soils are moderately deep and well drained. They formed in colluvium derived dominantly from sedimentary rock. The soils are channery and extremely channery and are medium textured. They are underlain by sandstone or marlstone at a depth of 20 to 40 inches.

Redcreek soils are sloping to steep. They are on mountainsides, uplands, and ridges. These soils are shallow and well drained. They formed in eolian deposits and residuum derived dominantly from sandstone. The surface layer is medium textured. The underlying material is channery and medium textured. Unweathered sandstone is at a depth of 10 to 20 inches.

Of minor extent in this unit are Abor, Mergel, Redthayne, Rentsac, and Thornburgh soils, Torriorthents, and Rock outcrop.

This unit is used mainly for livestock grazing and wildlife habitat. Some areas are also used for development of shale oil and natural gas production.

The main limitations of this unit for most uses are shallow depth to bedrock in the Castner and Redcreek soils, steepness of slope, and low available water capacity.

This unit provides habitat for rangeland wildlife such as elk, mule deer, cottontail, jackrabbit, bobcat, coyote, birds of prey, and grouse.

soils on mountains

This group consists of three map units. It makes up about 20 percent of the survey area. The soils in this group are gently sloping to very steep. The native vegetation is mainly mountain brush and shrubs and an understory of grasses. Elevation is 7,000 to 9,800 feet.

The soils in this group are shallow to deep and are well drained. They formed in alluvium, residuum, and colluvium derived dominantly from sedimentary rock.

This group is used mainly for livestock grazing and wildlife habitat. It is also used for coal mining, oil production, and some uranium mining.

10. Jerry-Thornburgh-Owen Creek

Moderately deep and deep, well drained, sloping to very steep soils

This map unit is in the east-central and northeastern parts of the survey area. It is mainly on mountainsides, narrow ridges, and hillcrests. Slopes generally face north and east and are 5 to 65 percent. The vegetation on this unit is mainly Gambel oak, serviceberry, and other shrubs and an understory of mixed grasses. Elevation is 7,000 to 9,500 feet. The average annual precipitation is about 16 to 20 inches, the average annual air temperature is 36 to 39 degrees F, and the average frost-free season is less than 75 days.

This unit makes up about 6 percent of the survey area. It is about 26 percent Jerry soils, 13 percent Thornburgh soils, and 11 percent Owen Creek soils. The remaining 50 percent is components of minor extent.

Jerry soils are sloping to steep. They are on mountainsides and on the broader ridgetops. These soils are deep and well drained. They formed in colluvium and residuum derived dominantly from shale. The surface layer is medium textured. Below this to a depth of 60 inches of more the soils are channery and moderately fine textured.

Thornburgh soils are moderately steep to very steep. They are on mountainsides. These soils are deep and well drained. They formed in colluvium and alluvium derived dominantly from sandstone. The surface layer is channery and medium textured. The subsoil is very channery and medium textured. The substratum to a depth of 60 inches or more is very channery and moderately coarse textured.

Owen Creek soils are sloping to moderately steep. They are on hillcrests, ridges, and mountainsides. These soils are moderately deep and well drained. They formed in residuum derived dominantly from interbedded shale and sandstone. The surface layer is medium textured. The subsoil is moderately fine textured and fine textured. Weathered shale interbedded with sandstone is at a depth of 24 to 60 inches or more.

Of minor extent in this unit are Burnette, Cochetopa, Rhone, and Waybe soils.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for coal mining, oil wells, and some uranium mining.

The main limitations for homesite development are steepness of slope, shrink-swell potential, slow permeability, and the hazards of landslides and erosion in disturbed areas.

This unit provides habitat year-round for rangeland wildlife such as elk, mule deer, cottontail, jackrabbit,

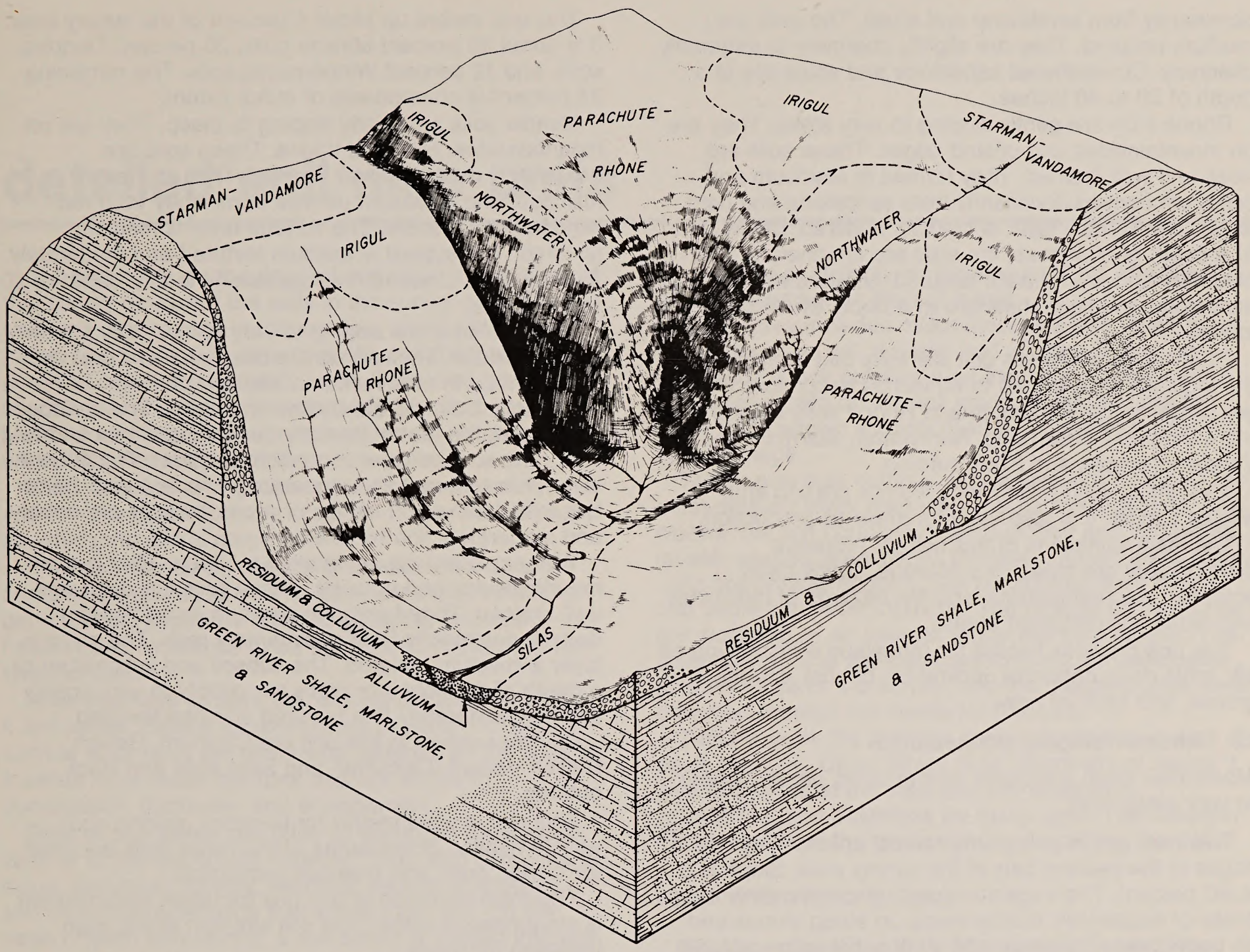


Figure 3.—Typical pattern of soils in general map unit 11.

bobcat, coyote, martin, chipmunks, grouse, and birds of prey.

11. Irigul-Parachute-Rhone

Shallow to deep, well drained, gently sloping to very steep soils

This map unit is in the southern part of the survey area. It is mainly on mountainsides, ridges, and hillcrests. Slope is 3 to 75 percent. The vegetation on this unit is mainly sagebrush with clumps of Gambel oak, serviceberry, and other low shrubs and an understory of grasses. Elevation is 7,000 to 8,700 feet. The average annual precipitation is about 18 to 23 inches, the average annual air temperature is 36 to 39 degrees F, and the average frost-free season is less than 75 days.

This unit makes up about 10 percent of the survey area. It is about 31 percent Irigul soils, 28 percent Parachute soils, and 12 percent Rhone soils. The remaining 29 percent is components of minor extent (fig. 3).

Irigul soils are sloping to very steep. They are on ridges, hillcrests, and mountainsides. These soils are shallow and well drained. They formed in residuum derived dominantly from sandstone and hard shale. The surface layer is channery and medium textured. Below this the soils are extremely channery and medium textured. Unweathered sandstone and marlstone are at a depth of 10 to 20 inches.

Parachute soils are sloping to very steep. They are on ridges and mountainsides. These soils are moderately deep and well drained. They formed in residuum derived

dominantly from sandstone and shale. The soils are medium textured. They are slightly channery to extremely channery. Unweathered sandstone and shale are at a depth of 20 to 40 inches.

Rhone soils are gently sloping to very steep. They are on mountainsides and upland ridges. These soils are deep and well drained. They formed in residuum and colluvium derived dominantly from sandstone and hard shale. The surface layer is medium textured. Below this, to a depth of 50 inches, the soils are channery to very channery and are medium textured. Unweathered sandstone and hard shale are at a depth of 40 to 60 inches.

Of minor extent in this unit are soils that are similar to the Irigul soils but are 20 to 40 inches deep; soils that are similar to the Parachute and Rhone soils but are more than 40 inches deep; Northwater, Starman, and Vandamore soils; and Rock outcrop.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for shale oil production.

The main limitations of this unit for homesite development are steepness of slope, shrink-swell potential, low permeability, and the hazards of landslides and erosion in disturbed areas.

This unit provides habitat for rangeland wildlife such as elk, mule deer, cottontail, jackrabbit, bobcat, coyote, grouse, and birds of prey.

12. Miracle-Tampico-Winnemucca

Moderately deep and deep, well drained, gently sloping to very steep soils

This map unit is on mountainsides, uplands, hills, and ridges in the eastern part of the survey area. Slope is 3 to 60 percent. The vegetation on this unit is mainly open areas of sagebrush, brushy areas on steep slopes and an understory of grasses and shrubs. Elevation is 7,200 to 9,800 feet. The average annual precipitation is about 20 to 25 inches, the average annual air temperature is 36 to 39 degrees F, and the average frost-free season is less than 75 days.

This unit makes up about 4 percent of the survey area. It is about 28 percent Miracle soils, 26 percent Tampico soils, and 12 percent Winnemucca soils. The remaining 34 percent is components of minor extent.

Miracle soils are gently sloping to steep. They are on mountainsides, hills, and ridges. These soils are moderately deep and well drained. They formed in residuum and colluvium derived dominantly from red sandstone and shale. The surface layer is medium textured. The subsoil is medium textured and moderately fine textured. Unweathered sandstone is at a depth of 20 to 40 inches.

Tampico soils are sloping to very steep. They are on mountainsides. These soils are deep and well drained. They formed in colluvium and alluvium derived dominantly from red sandstone and shale. The surface is covered with a mat of partially decomposed leaf and twig litter. The surface layer is medium textured. The subsoil is medium textured and moderately fine textured. Below this to a depth of 60 inches or more the soils are cobbly and moderately fine textured.

Winnemucca soils are sloping to steep. They are on mountainsides and uplands. These soils are deep and well drained. They formed in alluvium and colluvium derived dominantly from sedimentary rock. The surface layer is medium textured. The subsoil and substratum to a depth of 60 inches or more are cobbly to very cobbly and are moderately fine textured and fine textured.

Of minor extent in this unit are Clayburn, Delson, Delson Variant, Lamphier, and Silas soils and Rock outcrop.

This unit is used mainly for livestock grazing and wildlife habitat. Some areas of the minor soils are used for timber, pole, and firewood production.

The main limitation of this unit for urban development is steepness of slope. Low soil strength is the main limitation for roads.

This unit provides habitat for rangeland wildlife such as elk, mule deer, some black bear, jackrabbit, snowshoe hare, bobcat, coyote, badger, weasel, grouse, and birds of prey.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Patent loam, 3 to 8 percent slopes, is one of several phases in the Patent series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Irigul-Parachute complex, 5 to 30 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

This survey was mapped at two levels of detail. At the most detailed level, map units are narrowly defined. This means that soil boundaries were plotted and verified at closely spaced intervals. At the less detailed level, map units are broadly defined. Soil boundaries were plotted and verified at wider intervals. The broadly defined units are indicated by an asterisk in the soil map legend. The detail of mapping was selected to meet the anticipated long-term use of the survey, and the mapping units were designed to meet the needs for that use.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

map unit descriptions

1—Abor clay loam, 5 to 30 percent slopes. This moderately deep, well drained soil is on foothills and uplands. It formed in residuum derived dominantly from clayey shale. The native vegetation is mainly grasses and low shrubs. Elevation is 5,800 to 6,500 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 44 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is pale brown clay loam 4 inches thick. The upper 8 inches of the subsoil is silty clay loam, and the lower 12 inches is silty clay. The substratum is silty clay loam that has some gypsum and is 9 inches thick. Clayey shale is at a depth of 33 inches. Depth to shale ranges from 20 to 40 inches. In some areas the surface layer is channery clay loam.

Included in this unit are small areas of Bulkley channery silty clay loam, Dollard silty clay loam, and Moyerson stony clay loam. Also included are small areas of Rock outcrop. Rock outcrop consists of small, nearly vertical ledges of sandstone 5 to 25 feet high. Included areas make up about 15 percent of the total acreage.

Permeability of this Abor soil is slow to very slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, green needlegrass, muttongrass, big sagebrush, and dwarf rabbitbrush. Junegrass, fourwing saltbush, and winterfat commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 900 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the range is in poor condition, brush management and seeding are suitable practices where slopes are less than 15 percent. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass VIe. It is in Clayey Foothills range site.

2—Absarokee-Delson channery loams, 8 to 65 percent slopes. This map unit is on mountainsides. Areas are elongated and are 80 to 1,500 acres. The native vegetation is mainly brush and grasses. Elevation is 6,600 to 7,500 feet. The average annual precipitation is 17 to 20 inches, the average annual air temperature is 40 to 43 degrees F, and the average frost-free period is 80 to 105 days.

This unit is 55 percent Absarokee channery loam that has slopes of 8 to 65 percent and 35 percent Delson channery loam that has slopes of 8 to 25 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Clayburn loam, Irigul channery loam, Kobar silty clay loam, Nagitsy channery loam, and Winnemucca loam. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage.

The Absarokee soil is moderately deep and well drained. It formed in residuum derived dominantly from sedimentary rock. Typically, the surface layer is dark grayish brown channery loam 4 inches thick. The upper 7 inches of the subsoil is brown channery clay loam, and the lower 11 inches is brown channery clay loam. Bedrock is at a depth of 22 inches. Depth to sandstone and hard shale ranges from 20 to 40 inches.

Permeability of the Absarokee soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is high to very high.

The Delson soil is deep and well drained. It formed in mixed alluvium and colluvium derived dominantly from sedimentary material. Typically, the upper part of the surface layer is grayish brown channery loam about 7 inches thick. The lower part is brown clay loam about 7 inches thick. The subsoil is brown clay 29 inches thick. Below this to a depth of 60 inches or more is brown clay. Some small cracks less than 1/2 inch wide extend to a depth of 36 inches during prolonged dry periods.

Permeability of the Delson soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Gambel oak, serviceberry, Letterman needlegrass, and elk sedge. Smaller amounts of common snowberry, mountain brome, and western wheatgrass commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are suitable practices where slopes are less than 15 percent. The main limitation for seeding is the stony surface layer. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass VIIe, nonirrigated. It is in Brushy Loam range site.

3—Absher loam, 0 to 3 percent slopes. This deep, well drained soil is on alluvial valley floors, fans, and terraces. It formed in alluvium derived dominantly from shale. Areas are elongated and are 20 to 200 acres. The native vegetation is mainly salt-tolerant shrubs and grasses. Elevation is 6,000 to 7,300 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 44 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is very pale brown loam 3 inches thick. The upper 10 inches of the subsoil is moderately alkaline, brown and pinkish gray silty clay, and the lower 10 inches is strongly alkaline, pale brown clay loam. The substratum to a depth of 60 inches or

more is mainly pale brown clay loam that commonly has gypsum crystals.

Included in this unit are small areas of Havre loam, Patent loam, and Kobar silty clay loam. Also included are small areas of severely gullied and eroded Absher soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Absher soil is very slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high.

Most areas of this unit are used for livestock grazing and irrigated crops, mainly hay and pasture. A few areas are used for nonirrigated grain crops and wildlife habitat. Wheat is the main nonirrigated crop.

The potential plant community on this unit is mainly western wheatgrass, Indian ricegrass, big sagebrush, greasewood, winterfat, and bottlebrush squirreltail. Smaller amounts of saltgrass, fourwing saltbush, and tall rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by salinity and low precipitation. The average annual production of air-dry vegetation is about 650 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Range seeding is also suitable if the range is in poor condition. The main limitation is salinity. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Salt-tolerant grasses can be grown. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If this unit is used for hay and pasture, the main limitations are salinity and very slow permeability. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for nonirrigated grain crops, the main limitations are the high salinity, slow permeability, and hazard of erosion. Areas of nonirrigated cropland are highly susceptible to water erosion and soil blowing and generally should be seeded to grass.

This map unit is in capability subclasses IVs, irrigated, and VIs, nonirrigated. It is in Alkaline Slopes range site.

4—Absher loam, 3 to 8 percent slopes. This deep, well drained soil is on fans and terraces. It formed in alluvium derived dominantly from shale. Areas are irregular in shape and are 20 to 300 acres in size. The native vegetation is mainly salt-tolerant shrubs and grasses. Elevation is 6,000 to 7,300 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 44 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is very pale brown loam 3 inches thick. The upper 10 inches of the subsoil is moderately alkaline, brown and pinkish gray silty clay, and the lower 10 inches is strongly alkaline, pale brown clay loam. The substratum to a depth of 60 inches or more is mainly pale brown clay loam that commonly has gypsum crystals.

Included in this unit are small areas of Havre loam, Patent loam, and Kobar silty clay loam. Also included are small areas of severely gullied and eroded Absher soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Absher soil is very slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate to very high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for nonirrigated grain crops. Wheat is the main nonirrigated crop.

The potential plant community on this unit is mainly western wheatgrass, Indian ricegrass, big sagebrush, greasewood, winterfat, and bottlebrush squirreltail. Smaller amounts of saltgrass, fourwing saltbush, and tall rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by salinity and low precipitation. The average annual production of air-dry vegetation is about 550 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Range seeding is also suitable if the range is in poor condition. The main limitation is salinity. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Salt-tolerant grasses can be grown. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If this unit is used for nonirrigated grain crops, the main limitations are the high salinity, slow permeability, and hazard of erosion. Areas of nonirrigated cropland

are highly susceptible to water erosion and soil blowing and generally should be reseeded to grass.

This map unit is in capability subclass VIe, nonirrigated. It is in Alkaline Slopes range site.

5—Badland. This map unit is on rolling to very steep, nearly barren mountainsides, low hills, ridgetops, and canyonsides. Slope is 10 to 65 percent. Areas generally are oval to elongated and are 20 to 300 acres. The native vegetation is mainly very sparse low desert shrubs and grasses. Elevation is 5,200 to 7,300 feet. The average annual precipitation is 8 to 18 inches, the average annual air temperature is 40 to 50 degrees F, and the average frost-free period is 75 to 130 days.

Badland is very shallow and exhibits no significant soil characteristics. The soil material consists of residuum derived dominantly from highly calcareous and gypsiferous shale and bentonite.

Included in this unit are small areas of Chipeta and Dollard silty clay loams, Moyerson clay loam, and Rock outcrop.

Permeability of Badland is very slow. Available water capacity is very slow. Effective rooting depth is 0 to 10 inches. Runoff is very rapid, and the hazard of water erosion is very high, which results in a large amount of sedimentation during rainstorms and when snow melts.

Use of this unit is very limited. The bentonite deposits are used locally as a sealing material for canals and ponds.

This map unit is in capability class VIII.

6—Barcus channery loamy sand, 2 to 8 percent slopes. This deep, somewhat excessively drained soil is on alluvial fans and in narrow valleys. It formed in alluvium derived from calcareous sandstone and shale. Areas are fan shaped, triangular, or elongated and are 20 to 100 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 6,800 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 44 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is pale brown channery loamy sand 6 inches thick. The upper part of the underlying material is light yellowish brown channery sand 10 inches thick, and the lower part to a depth of 60 inches or more is stratified, light yellowish brown and pale brown very channery sand and very channery loamy fine sand. The soil is calcareous throughout. In some areas the surface layer is channery fine sandy loam or channery sand.

Included in this unit are small areas of Glendive fine sandy loam and Havre loam. Also included are small areas of moderately deep Torriorthents and areas of soils that have a cobbly surface layer. Included areas make up about 15 percent of the total acreage.

Permeability of the Barcus soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used as a source of roadfill.

The potential plant community on this unit is mainly western wheatgrass, basin wildrye, Indian ricegrass, and big sagebrush. Smaller amounts of needleandthread, rubber rabbitbrush, fourwing saltbush, and winterfat commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, brush management, and seeding. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. The main limitation for seeding is low precipitation.

This unit is well suited as a source of roadfill.

This map unit is in capability subclass VIe, nonirrigated. It is in Foothill Swale range site.

7—Billings silty clay loam, 0 to 5 percent slopes. This deep, well drained soil is on alluvial valley floors, flood plains, narrow valley floors, and terraces. It formed in calcareous, silty alluvium derived dominantly from shale. The native vegetation is mainly desert shrubs and grasses. Elevation is 5,100 to 5,800 feet. The average annual precipitation is 6 to 8 inches, the average annual air temperature is 47 to 49 degrees F, and the average frost-free period is 105 to 135 days.

Typically, the upper part of the surface layer is light gray silty clay loam about 2 inches thick. The lower part is pale brown silty clay loam about 4 inches thick. The underlying material to a depth of 60 inches or more is silty clay loam that has a few fine gypsum crystals.

Included in this unit are small areas of Turley fine sandy loam, Nihill channery sandy loam, Chipeta silty clay loam, and Killpack silty clay loam. Also included are small areas of highly eroded and gullied soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Billings soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate to high.

This unit is used for livestock grazing and irrigated crops. Hay and pasture are the main irrigated crops. A few areas are used for irrigated small grain and corn for ensilage.

The potential plant community on this unit is mainly greasewood, gardner saltbush, Indian ricegrass, and bottlebrush squirreltail. Western wheatgrass, big sagebrush, and winterfat commonly are also present in the potential plant community. The production of forage is limited by low precipitation and rapid runoff. The average annual production of air-dry vegetation is about 650 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Range seeding is also suitable if the range is in poor condition. The main limitation for seeding is low precipitation. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for irrigated crops, the main limitations are the slow permeability, slight salinity, strong alkalinity, a short growing season, and a limited supply of irrigation water. Most of these limitations can be overcome by land leveling, managing irrigation water, and using crop residue.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. The system used generally is governed by the crop grown. Water needs to be applied at a slow rate over a long period to insure that the root zone is properly wetted.

Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus.

If this unit is used for urban development, the main limitations are the shrink-swell potential, frost action potential, and slow permeability. The effects of shrinking and swelling can be reduced by maintaining a constant moisture content around the foundation and by backfilling excavations with material that has low shrink-swell potential.

If this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclasses IIIe, irrigated, and VIe, nonirrigated. It is in Alkaline Slopes range site.

8—Billings-Torrifluvents complex, gullied, 0 to 5 percent slopes. This map unit is on flood plains, low terraces, and narrow valley floors. Areas are long and narrow and are 20 to 160 acres. The native vegetation is mainly desert shrubs and sparse grasses. Elevation is 5,100 to 5,600 feet. The average annual precipitation is 7 to 9 inches, the average annual air temperature is 47 to 49 degrees F, and the average frost-free period is 105 to 135 days.

This unit is 55 percent Billings silty clay loam that has slopes of 0 to 5 percent and 35 percent Torrifluvents that have slopes of 0 to 5 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Killpack silty clay loam and Turley fine sandy loam. Also included are small strongly saline and alkaline spots and areas of soils that have a loam or sandy loam surface layer. Included areas make up about 10 percent of the total acreage.

The Billings soil is deep and well drained. It formed in calcareous mixed alluvium derived dominantly from shale. Typically, the upper part of the surface layer is light gray silty clay loam about 2 inches thick. The underlying material to a depth of 60 inches or more is gypsiferous silty clay loam.

Permeability of the Billings soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

Torrifluvents consist of highly stratified and gullied alluvium. The surface layer ranges from gravelly sandy loam to silty clay. The underlying material ranges from loam to silty clay loam. Gullies and headcuts are 1 foot to 25 feet deep and 3 to 75 feet wide. These soils are slightly saline to strongly saline. Gypsum crystals are common throughout the profile. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used for very limited livestock grazing.

The potential plant community on this unit is mainly greasewood, gardner saltbush, Indian ricegrass, bottlebrush squirreltail, big sagebrush, and winterfat. The production of forage is limited by low precipitation, salinity, and excessive runoff. The average annual production of air-dry vegetation is about 350 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Livestock grazing should also be managed to protect the unit from excessive erosion.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. The suitability of this unit for rangeland seeding is very poor. The main limitations are the numerous gullies, excessive runoff, slow permeability, salinity, and strong alkalinity. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This map unit is in capability subclass VIIe, nonirrigated. It is in Alkaline Slopes range site.

9—Blakabin-Rhone-Waybe complex, 5 to 50 percent slopes. This map unit is on mountainsides and ridges. Areas are irregular in shape and are 20 to 500 acres in size. The native vegetation is mainly brush and grasses. Elevation is 7,200 to 8,500 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 40 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 45 percent Blakabin clay loam that has slopes of 5 to 50 percent, 25 percent Rhone loam that has slopes of 5 to 50 percent, and 20 percent Waybe flaggy clay loam that has slopes of 15 to 30 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Moyerson stony clay loam, Parachute loam, Razorba channery sandy loam, and Rentsac, Vandamore, and Veatch channery loams. Also included are small areas of Rock outcrop and areas of more steeply sloping soils. Included areas make up about 10 percent of the total acreage.

The Blakabin soil is deep and well drained. It formed in residuum and colluvium derived dominantly from sandstone and shale. Typically, the surface layer is dark grayish brown clay loam 3 inches thick. The upper 11 inches of the subsoil is grayish brown clay loam, the next 11 inches is light brownish gray clay loam, and the lower 7 inches is light brownish gray clay. The upper 18 inches of the substratum is light brownish gray clay, and the lower part to a depth of 60 inches or more is light brownish gray clay loam.

Permeability of the Blakabin soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate to very high.

The Rhone soil is deep and well drained. It formed in colluvium derived dominantly from sandstone and hard shale. Typically, the upper part of the surface layer is dark grayish brown loam about 24 inches thick. The lower part is grayish brown very channery loam about 18 inches thick. The underlying material is brown very channery loam about 8 inches thick. Fractured sandstone is at a depth of 50 inches. Depth to sandstone ranges from 40 to 60 inches.

Permeability of the Rhone soil is moderate. Available water capacity is high. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is slight to very high.

The Waybe soil is shallow and well drained. It formed in residuum derived dominantly from interbedded shale and sandstone. Typically, the surface layer is pale brown flaggy clay loam 4 inches thick. The underlying material is mainly light brownish gray channery silty clay loam about 15 inches thick. Shale is at a depth of 19 inches. Depth to shale and sandstone ranges from 10 to 20 inches.

Permeability of the Waybe soil is slow. Available water capacity is low to moderate. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Blakabin and Rhone soils is mainly Utah serviceberry, snowberry, mountain brome, elk sedge, slender wheatgrass, and bluegrasses. The potential plant community on the Waybe soil is bluebunch wheatgrass, bottlebrush squirreltail, streambank wheatgrass, Colorado buckwheat, winterfat, and Douglas rabbitbrush. The average annual production of air-dry vegetation on this unit is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are also suitable practices where slopes are less than 15 percent. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. The main limitations for seeding are the difficulty of brush removal and slope. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited.

This map unit is in capability subclass VIIe, nonirrigated. About 75 percent of the unit is in Brushy Loam range site, and 25 percent is in Dry Exposure range site.

10—Blazon, moist-Rentsac complex, 8 to 65 percent slopes. This map unit is on foothills and ridges. Areas are irregular in shape and are 100 to 2,500 acres in size. The native vegetation is mainly pinyon and juniper trees with an understory of brush and grasses. Elevation is 5,700 to 6,900 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 42 to 44 degrees F, and the average frost-free period is 80 to 105 days.

This unit is 50 percent Blazon channery loam and 35 percent Rentsac channery loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Havre and Jerry loams, Thornburgh channery loam, Moyerson stony clay

loam, and Patent and Rhone loams. Also included are small areas of Rock outcrop and soils that are similar to the Blazon and Rentsac soils but are moderately deep. Included areas make up about 15 percent of the total acreage.

The Blazon soil is shallow and well drained. It formed in residuum derived dominantly from shale. Typically, the upper part of the surface layer is brown channery loam about 4 inches thick. The lower part is brown channery clay loam about 7 inches thick. The underlying material is light yellowish brown shaly clay loam about 5 inches thick. Soft shale is at a depth of 16 inches. Depth to soft shale ranges from 10 to 20 inches.

Permeability of the Blazon soil is moderately slow. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate to very high.

The Rentsac soil is shallow and well drained. It formed in residuum derived dominantly from sandstone. Typically, the surface layer is grayish brown channery loam about 5 inches thick. The next layer is brown very channery loam about 4 inches thick. The underlying material is very pale brown extremely flaggy loam about 7 inches thick. Hard sandstone is at a depth of 16 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Rentsac soil is moderately rapid. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate to very high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used as woodland.

The potential plant community on this unit is mainly pinyon and juniper trees with an understory of Indian ricegrass, beardless wheatgrass, Utah serviceberry, mountainmahogany, big sagebrush, and stemless goldenwheat. Smaller amounts of bitterbrush, needleandthread, western wheatgrass, and bottlebrush squirreltail commonly are also present in the potential plant community. The production of forage is limited by rapid runoff and low precipitation. The potential production of the native understory vegetation in normal years is about 550 pounds of air-dry vegetation per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited.

Woodland products such as firewood, fenceposts, and Christmas trees are available on this unit. The major limitations in harvesting the pinyon and juniper trees are steepness of slope and poor accessibility.

This map unit is in capability subclass VIIe, nonirrigated. It is in Pinyon-Juniper woodland site.

11—Borollic Calciorthids-Guben complex, 6 to 50 percent slopes. This map unit is on uplands and the sides of terraces. Areas are long and narrow and are 20 to 160 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 6,900 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 41 to 44 degrees F, and the average frost-free period is 80 to 105 days.

This unit is 55 percent Borollic Calciorthids that have slopes of 6 to 50 percent and 35 percent Guben loam that has slopes of 6 to 15 percent. The Borollic Calciorthids are on the sides of terraces, and the Guben soil is on uplands. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Work loam and Zoltay clay loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Borollic Calciorthids are moderately deep and deep and are well drained. They formed in very calcareous alluvial and glacial outwash derived from mixed sources. The surface layer is gravelly or cobbly loam, clay loam, or sandy loam 2 to 5 inches thick. The underlying material ranges from very gravelly sandy loam or cobbly sandy loam to very gravelly loamy sand or cobbly loamy sand. Calcium carbonate content is more than 15 percent. Depth to soft shale or sandstone ranges from 20 to 60 inches or more.

Permeability of the Borollic Calciorthids is moderately rapid to rapid. Available water capacity is low. Effective rooting depth is 20 to 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

The Guben soil is deep and well drained. It formed in thin eolian deposits over calcareous alluvium and glacial outwash derived from mixed sources. Typically, the surface layer is grayish brown loam 6 inches thick. The next layer is brown loam 5 inches thick. The upper 4 inches of the underlying material is pale brown gravelly loam, the next 8 inches is white very gravelly loam, and the lower part to a depth of 60 inches or more is mainly stratified very cobbly sandy loam that is more than 15 percent calcium carbonate. In some areas the surface layer is sandy loam that is as much as 20 percent gravel and cobbles.

Permeability of the Guben soil is moderate. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to high.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used as a source of roadfill and gravel. Some small areas are used for irrigated pasture.

The potential plant community on the Borollic Calciorthids is mainly galleta, bluebunch wheatgrass, sand dropseed, big sagebrush, Indian ricegrass, and blue grama. The potential plant community on the Guben soil is mainly big sagebrush, western wheatgrass, needleandthread, prairie junegrass, muttongrass, and low rabbitbrush. Smaller amounts of Utah serviceberry, Indian ricegrass, and bluegrass commonly are also present in the potential plant community. The average annual production of air-dry vegetation on this unit is about 750 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

If this unit is used for hay and pasture, the main limitations are steepness of slope of the Borollic Calciorthids, low available water capacity, and the narrow width and small size of the areas of the Guben soil.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage. Irrigation water can be applied by the flooding or sprinkler method.

This unit is well suited as a source of roadfill, gravel, and some topsoil. The main limitations are the difficulty of reclamation, steepness of slope, and droughtiness. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. If the soils are used as a base for roads and streets, the upper part of the soils can be mixed with the underlying sand and gravel to increase their strength and stability.

This map unit is in capability subclass VIe. The Borollic Calciorthids are in Stony Foothills range site, and the Guben soil is in Rolling Loam range site.

12—Bucklon-Inchau loams, 25 to 50 percent slopes. This map unit is on ridges and mountainsides. Areas are irregular in shape and are 20 to 100 acres in size. The native vegetation is mainly brush and grasses. Elevation is 7,000 to 9,500 feet. The average annual precipitation is 18 to 20 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 55 percent Bucklon loam that has slopes of 25 to 50 percent and 35 percent Inchau loam that has slopes of 25 to 40 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cochetopa and Jerry loams and Miracle fine sandy loam. Also included are small areas of Rock outcrop and areas of soils that are less sloping than the Bucklon and Inchau soils. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Bucklon soil is shallow and well drained. It formed in residuum derived dominantly from interbedded sandstone and shale. Typically, the surface layer is brown loam 10 inches thick. The underlying material is pale brown clay loam 7 inches thick. Sandstone is at a depth of 17 inches.

Permeability of the Bucklon soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is very high.

The Inchau soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from sedimentary rock. Typically, the surface layer is dark grayish brown loam 5 inches thick. The upper 6 inches of the subsoil is dark grayish brown loam, the next 11 inches is brown gravelly clay loam, and the lower 6 inches is brown gravelly loam. The substratum is grayish brown gravelly loam 7 inches thick. Sandstone is at a depth of 35 inches. Depth to bedrock ranges from 20 to 40 inches.

Permeability of the Inchau soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Gambel oak, Utah serviceberry, elk sedge, bromegrasses, snowberry, and Kentucky bluegrass. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited.

This map unit is in capability subclass VIIe, nonirrigated. It is in Brushy Loam range site.

13—Bulkley channery silty clay loam, 5 to 30 percent slopes. This deep, well drained soil is on

uplands and hillsides. It formed in residuum and colluvium derived dominantly from calcareous clayey shale. Areas are irregular in shape and are 60 to 1,000 acres in size. The native vegetation is mainly sparse stands of pinyon and juniper trees, brush, and grasses. Elevation is 6,500 to 7,200 feet. The average annual precipitation is 16 to 19 inches, the average annual air temperature is 42 to 44 degrees F, and the average frost-free period is 80 to 95 days.

Typically, the surface layer is pale brown channery silty clay loam 5 inches thick. The subsoil is very pale brown silty clay loam 15 inches thick. The substratum is very pale brown silty clay about 28 inches thick. Shale is at a depth of 48 inches. Depth to shale ranges from 40 to 60 inches. The subsoil and substratum crack when dry.

Included in this unit are small areas of Abor clay loam, Moyerson stony clay loam, and soils that have a clay loam or loam surface layer. Also included are small areas of soils that have a flaggy surface layer and shale outcroppings. Included areas make up about 15 percent of the total acreage.

Permeability of the Bulkley soil is slow. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing and wildlife habitat. It also has limited use as woodland.

The potential plant community on this unit is mainly sparse stands of pinyon and Utah juniper with a good understory of beardless wheatgrass, muttongrass, saline wildrye, and serviceberry. Smaller amounts of low rabbitbrush, black sagebrush, and streambank wheatgrass commonly are also present in the potential plant community. The production of forage is limited by the loss of moisture through excessive runoff. The average annual production of air-dry vegetation is about 600 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are also suitable practices where slopes are less than 15 percent. The main limitations for seeding are competition from the pinyon and juniper trees and the hazard of erosion. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is well suited to pinyon and Utah juniper. The pinyon and juniper trees commonly are used for firewood, fenceposts, and Christmas trees. The main concern in producing and harvesting timber is the hazard of gully erosion in areas where water concentrates on and along roadways.

This map unit is in capability subclass VIe, nonirrigated. It is in Pinyon-Juniper woodland site.

14—Bulkley-Abor clay loams, 5 to 30 percent slopes. This map unit is on toe slopes and benches. Areas are irregular in shape and are 20 to 500 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 6,600 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 42 to 44 degrees F, and the average frost-free period is 80 to 105 days.

This unit is 60 percent Bulkley clay loam and 30 percent Abor clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Dollard silty clay loam, Pinelli clay loam, and Kobar silty clay loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Bulkley soil is deep and well drained. It formed in residuum derived dominantly from calcareous clayey shale. Typically, the surface layer is grayish brown clay loam 3 inches thick. The upper 14 inches of the subsoil is grayish brown silty clay, and the lower 12 inches is grayish brown silty clay. Cracks 1 inch to 3 inches wide and 30 inches deep are common when the subsoil is dry. The substratum is light brownish gray silty clay 29 inches thick. Soft shale is at a depth of about 58 inches. Depth to shale ranges from 40 to 60 inches.

Permeability of the Bulkley soil is slow. Available water capacity is moderate to high. Effective rooting depth is 40 to 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate to very high.

The Abor soil is moderately deep and well drained. It formed in residuum derived dominantly from calcareous clayey shale. Typically, the surface layer is light brownish gray clay loam 4 inches thick. The upper 8 inches of the subsoil is light brownish gray silty clay loam, and the lower 12 inches is pale brown silty clay. The substratum is very pale brown silty clay loam 9 inches thick. Calcareous clayey shale is at a depth of about 33 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Abor soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate to very high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for nonirrigated small grain and for irrigated hay and pasture.

The potential plant community on this unit is mainly western wheatgrass, streambank wheatgrass, Indian ricegrass, big sagebrush, green needlegrass, and Douglas rabbitbrush. The average annual production of air-dry vegetation is about 900 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are also suitable practices where slopes are less than 15 percent. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

Areas of nonirrigated cropland are highly susceptible to water erosion and soil blowing and generally should be seeded to grass when crops are not growing.

Areas of this unit that have slopes of less than 8 percent are suited to hay and pasture. The main limitations are the slow permeability and short growing season. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation.

This map unit is in capability subclass VIe. It is in Clayey Foothills range site.

15—Castner channery loam, 5 to 50 percent slopes. This shallow, well drained soil is on mountainsides, ridgetops, and uplands. It formed in residuum derived from sandstone. Areas are elongated and are 20 to 750 acres. The native vegetation is mainly pinyon and juniper with an understory of brush and grasses. Elevation is 6,900 to 7,800 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the upper part of the surface layer is dark grayish brown channery loam about 7 inches thick. The lower part is dark grayish brown very channery loam about 4 inches thick. The underlying material is grayish brown, calcareous very channery loam about 6 inches thick. Sandstone is at a depth of 17 inches. Depth to sandstone ranges from 10 to 20 inches.

Included in this unit are small areas of Rentsac channery loam and Yamac loam. Also included are small areas of Rock outcrop and soils that are similar to this Castner soil but are moderately deep to sandstone. Included areas make up about 10 to 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Castner soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to very high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used as woodland.

The potential plant community on this unit is mainly pinyon and juniper with an understory of beardless wheatgrass, dryland sedges, streambank wheatgrass, muttongrass, and Indian ricegrass. Smaller amounts of Utah serviceberry, antelope bitterbrush, and prairie junegrass commonly are also present in the potential plant community.

The production of forage is limited mainly by competition from pinyon and juniper. The potential production of the native understory vegetation in normal years is about 600 pounds of air-dry vegetation per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited.

The pinyon and juniper trees commonly are used for firewood, fenceposts, and Christmas trees. Access is limited because of the steepness of slope.

This map unit is in capability subclass VIIe, nonirrigated. It is in Pinyon-Juniper woodland site.

16—Chipeta silty clay loam, 3 to 25 percent slopes. This shallow, well drained soil is on low, rolling hills and on toe slopes. It formed in residuum derived from calcareous, gypsiferous shale. Areas are rounded to irregular in shape and are 20 to 800 acres in size. The native vegetation is mainly salt-tolerant shrubs and grasses. Elevation is 5,100 to 5,800 feet. The average annual precipitation is 7 to 9 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 105 to 135 days.

Typically, the surface layer is light brownish gray silty clay loam about 3 inches thick. The next layer is light olive gray silty clay about 6 inches thick. The underlying material is light olive gray silty clay that has fine shale chips and seams of crystalline gypsum and is about 9 inches thick. Shale is at a depth of 18 inches. Depth to shale ranges from 10 to 20 inches.

Included in this unit are small areas of Billings and Killpack silty clay loams and Turley fine sandy loam. Included areas make up about 10 to 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Chipeta soil is slow. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for urban development and the production of oil and natural gas.

The potential plant community on this unit is mainly mat saltbush, gardner saltbush, Indian ricegrass,

bottlebrush squirreltail, shadscale, and green rabbitbrush. Smaller amounts of galleta, salina wildrye, and spiny horsebrush commonly are also present in the potential plant community. The production of forage is limited by the low precipitation, slow permeability, and excessive runoff. The average annual production of air-dry vegetation is about 350 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

The suitability of this unit for rangeland seeding is poor. The main limitations are shallow depth to shale, low precipitation, and slow permeability.

This unit is poorly suited to urban development.

This map unit is in capability subclass VIIe, nonirrigated. It is in Clayey Saltdesert range site.

17—Chipeta silty clay loam, 3 to 25 percent slopes, eroded. This shallow, well drained soil is on low, rolling hills and on toe slopes (fig. 4). It formed in residuum derived from calcareous, gypsiferous shale. Areas are irregular in shape and are 20 to 1,000 acres in size. The native vegetation is mainly sparse stands of salt-tolerant desert shrubs and grasses. Elevation is 5,100 to 5,800 feet. The average annual precipitation is 7 to 9 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 105 to 135 days.

Typically, the surface layer is light brownish gray silty clay loam 2 inches thick. The underlying material is light brownish gray silty clay that has fine chips of shale and seams of crystalline gypsum and is about 10 inches thick. Shale is at a depth of 12 inches. Depth to shale ranges from 10 to 20 inches.

Figure 4.—Area of Chipeta silty clay loam, 3 to 25 percent slopes, eroded, in foreground; Rangely Basin, showing the nearly vertical slopes of the shaly badlands, in background.

Included in this unit are small areas of Billings and Killpack silty clay loams. Also included are small areas of shale outcroppings and soils that are severely gullied and entrenched. Included areas make up about 10 to 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this eroded Chipeta soil is slow. Available water capacity is very low. Effective rooting depth is 7 to 20 inches. Runoff is rapid, and the hazard of water erosion is very high.

Most areas of this unit are used for limited livestock grazing. A few areas are used for the production of oil and natural gas.

The potential plant community on this unit is mainly a sparse cover of mat saltbush, green rabbitbrush, bottlebrush squirreltail, Indian ricegrass, galleta, and buckwheat. The production of forage is limited by the low precipitation, slow permeability, and excessive runoff. The average annual production of air-dry vegetation is about 250 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

The suitability of this unit for rangeland seeding is very poor. The main limitations are shallow depth to shale, low precipitation, and slow permeability.

This unit is very poorly suited to urban development.

This map unit is in capability subclass VIIe, nonirrigated. It is in Clayey Saltdesert range site.

18—Chipeta-Killpack silty clay loams, 3 to 15 percent slopes. This map unit is on low, rolling hills and on ridges, toe slopes, and the sides of narrow valleys. The native vegetation is mainly salt-tolerant desert shrubs and some grasses. Elevation is 5,100 to 5,800 feet. The average annual precipitation is 7 to 9 inches, the average annual air temperature is 47 to 49 degrees F, and the average frost-free period is 105 to 135 days.

This unit is 60 percent Chipeta silty clay loam that has slopes of 3 to 15 percent and 30 percent Killpack silty clay loam that has slopes of 3 to 8 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Billings silty clay loam and Turley fine sandy loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Chipeta soil is shallow and well drained. It formed in residuum derived dominantly from calcareous, gypsiferous shale. Typically, the surface layer is light brownish gray silty clay loam about 3 inches thick. The next layer is silty clay about 6 inches thick. The underlying material is silty clay that has fine shale chips and seams of crystalline gypsum and is about 9 inches thick. Platy shale is at a depth of 18 inches. Depth to shale ranges from 10 to 20 inches.

Permeability of the Chipeta soil is slow. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Killpack soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from calcareous, gypsiferous shale. Typically, the surface layer is light gray and light brownish gray silty clay loam 4 inches thick. The underlying material is silty clay loam that has some fine shale chips and seams of crystalline gypsum and is 26 inches thick. Platy shale is at a depth of 30 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Killpack soil is slow. Available water capacity is moderately low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for the production of natural gas and oil.

The potential plant community on this unit is mainly mat saltbush, gardner saltbush, Indian ricegrass, and bottlebrush squirreltail. Shadscale, saline wildrye, spiny horsebrush, and low rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by low precipitation and rapid runoff. The average annual production of air-dry vegetation is about 400 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of low precipitation and rapid runoff.

If this unit is used for urban development, the main limitations are shallow soil depth, slow permeability, and rapid runoff.

This map unit is in capability subclass VIIe. It is in Clayey Saltdesert range site.

19—Chipeta-Walknolls complex, 5 to 15 percent slopes. This map unit is on low hills and ridges. Areas are irregular in shape and are 40 to 800 acres in size. The native vegetation is mainly salt-tolerant desert shrubs and grasses. Elevation is 5,300 to 6,000 feet. The average annual precipitation is 7 to 9 inches, the average annual air temperature is 47 to 50 degrees F, and the average frost-free period is 105 to 135 days.

This unit is 45 percent Chipeta silty clay loam and 35 percent Walknolls channery sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Potts fine sandy loam, Glenton sandy loam, Killpack silty clay loam, and Kinnear fine sandy loam. Also included are small areas of Rock outcrop and soils that are less than 10 inches deep. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Chipeta soil is shallow and well drained. It formed in residuum derived dominantly from gypsiferous shale. Typically, the surface layer is light gray and light brownish gray silty clay loam 5 inches thick. The underlying material is light gray silty clay 7 inches thick. Shale is at a depth of 12 inches. Depth to shale ranges from 10 to 20 inches.

Permeability of the Chipeta soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is high.

The Walknolls soil is shallow and well drained. It formed in residuum derived dominantly from calcareous sandstone. Typically, the surface layer is pale brown channery sandy loam 4 inches thick. The underlying material is pale brown extremely channery sandy loam 8 inches thick. Sandstone is at a depth of 12 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Walknolls soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Chipeta soil is mainly gardner saltbrush, salina wildrye, bottlebrush squirreltail, Indian ricegrass, low rabbitbrush, and galleta. Smaller amounts of shadscale, spiny horsebrush, and big sagebrush commonly are also present in the potential plant community.

The potential plant community on the Walknolls soil is mainly Indian ricegrass, galleta, needleandthread, thickspike wheatgrass, Douglas rabbitbrush, and shadscale. Smaller amounts of big sagebrush and a few Utah juniper trees commonly are also present in the potential plant community.

The production of forage is limited by low precipitation and low available water capacity. The average annual production of air-dry vegetation is about 350 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

The suitability of this unit for rangeland seeding is very poor. The main limitations are depth to rock and low precipitation.

This map unit is in capability subclass VIIe, nonirrigated. The Chipeta soil is in Clayey Saltdesert range site, and the Walknolls soil is in Saltdesert Breaks range site.

20—Clayburn loam, 3 to 15 percent slopes. This deep, well drained soil is on mountainsides, toe slopes, and ridgetops. It formed in alluvium and colluvium derived from mixed sedimentary rock. Areas are elongated and are 20 to 300 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 7,200 to 8,600 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the upper part of the surface layer is dark grayish brown loam about 4 inches thick. The lower part is dark grayish brown loam about 10 inches thick. The upper 8 inches of the subsoil is dark grayish brown clay loam, and the lower 12 inches is dark grayish brown clay loam. The substratum to a depth of 60 inches or more is grayish brown clay loam.

Included in this unit are small areas of Cochetopa loam, Delson stony loam, Absarokee channery loam, and Winnemucca loam. Also included are small areas of soils that are similar to this Clayburn soil but have a clay loam surface layer and are more steeply sloping or have bedrock at a depth of 40 to 60 inches. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Clayburn soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used for livestock grazing, irrigated hay and pasture, and wildlife habitat. A few areas are used as sites for cabins and as a source of topsoil.

The potential plant community on this unit is mainly big sagebrush, mountain brome, Letterman needlegrass, western wheatgrass, Utah serviceberry, and common snowberry. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing.

Brush management and seeding are also suitable practices where slopes are less than 15 percent. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is suited to hay and pasture. The main limitation is the short growing season. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage.

If this unit is used for homesite development, the main limitations are the potential for shrinking and swelling and moderate permeability. Structures to divert runoff are needed if buildings and roads are constructed.

This unit is suitable as a source of topsoil.

This map unit is in capability subclass VIe, irrigated and nonirrigated. It is in Mountain Loam range site.

21—Cliffdown-Cliffdown Variant complex, 5 to 65 percent slopes. This map unit is on terrace side slopes. Areas are elongated and are 20 to 150 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 5,100 to 5,800 feet. The average annual precipitation is 7 to 9 inches, the average annual air temperature is 47 to 49 degrees F, and the average frost-free period is 105 to 135 days.

This unit is 60 percent Cliffdown gravelly loam that has slopes of 5 to 8 percent and 25 percent Cliffdown Variant very cobbly loam that has slopes of 8 to 65 percent.

Included in this unit are small areas of Kinnear fine sandy loam, Nihill channery sandy loam, and Uffens loam. Also included are small areas of soils that are similar to the Cliffdown and Cliffdown Variant soils but are moderately deep and small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Cliffdown soil is deep and somewhat excessively drained. It formed in calcareous alluvium. Typically, the surface layer is pale brown gravelly loam 5 inches thick. The underlying material to a depth of 60 inches or more is mainly light gray, calcareous very gravelly sandy loam that has thin strata of very gravelly loamy sand.

Permeability of the Cliffdown soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 60 inches or more. Runoff is medium to slow, and the hazard of water erosion is slight to moderate.

The Cliffdown Variant soil is moderately deep and well drained. It formed in calcareous, gravelly and cobbly alluvium derived from mixed sources. Typically, the surface layer is pale brown very cobbly loam 7 inches thick. The next 6 inches is brown, calcareous very gravelly loam. The underlying material is light brownish gray gravelly clay loam 11 inches thick. Weathered shale is at a depth of 24 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Cliffdown Variant soil is moderately slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate to high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for urban development and as a source of roadfill.

The potential plant community on this unit is mainly galleta, salina wildrye, shadscale, big sagebrush, Indian ricegrass, and scattered Utah juniper. Smaller amounts of needleandthread, bottlebrush squirreltail, western wheatgrass, winterfat, and Douglas rabbitbrush commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 350 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

Most of this unit is poorly suited to urban development; however, the less sloping areas are well suited to this use. The main limitation is steepness of slope.

The Cliffdown soil is suitable as a source of roadfill. If the soil is used as a base for roads and streets, the upper part of the soil can be mixed with the underlying sand and gravel to increase its strength and stability.

This map unit is in capability subclass VIIe, nonirrigated. It is in Saltdesert Breaks range site.

22—Clifterson channery loam, 1 to 15 percent slopes. This deep, well drained to somewhat excessively drained soil is on fans, foot slopes, and terraces. It formed in alluvium and colluvium derived dominantly from calcareous hard shale. The native vegetation is mainly salt-tolerant shrubs and grasses. Elevation is 5,000 to 5,800 feet. The average annual precipitation is 7 to 9 inches, the average annual air temperature is 47 to 50 degrees F, and the average frost-free period is 105 to 135 days.

Typically, the surface layer is light brownish gray channery loam 4 inches thick. The upper 18 inches of the underlying material is pale brown very channery loam, and the lower part to a depth of 60 inches or more is light gray, calcareous very channery loam. The channery fragments are hard and weather very slowly.

Included in this unit are small areas of Colorow sandy loam and Nihill channery sandy loam. Also included are small areas of soils that are similar to this Clifterson soil but have a very channery, flaggy, or stony loam surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Clifterson soil is moderately rapid. Available water capacity is low to moderate. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly galleta, Indian ricegrass, needleandthread, bottlebrush squirreltail, winterfat, and Douglas rabbitbrush. Smaller amounts of shadscale, budsage, and spiny horsebrush commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 700 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this soil are proper range use, deferred grazing, rotation grazing, and brush management.

The suitability of this unit for rangeland seeding is poor. The main limitations are low precipitation and droughtiness.

This map unit is in capability subclass VIe, nonirrigated. It is in Loamy Saltdesert range site.

23—Cochetopa loam, 9 to 50 percent slopes. This deep, well drained soil is on mountainsides and fans. It formed in alluvium and colluvium derived from sandstone and basalt. Areas are irregular in shape and are 20 to 350 acres in size. The native vegetation is mainly brush and grasses. Elevation is 7,000 to 9,500 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the upper part of the surface layer is dark grayish brown loam about 8 inches thick. The lower part is dark grayish brown loam about 11 inches thick. The upper 10 inches of the subsoil is dark grayish brown clay loam, and the lower 15 inches is yellowish brown clay. The substratum to a depth of 60 inches or more is grayish brown clay loam. In some areas the surface layer is cobbly loam.

Included in this unit are small areas of Jerry loam and Lamphier loam. Also included are small areas of soils that are similar to this Cochetopa soil but have a stony surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Cochetopa soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Gambel oak, Saskatoon serviceberry, mountain brome, elk sedge, slender wheatgrass, and Kentucky bluegrass. Smaller amounts of nodding brome, common snowberry, and chokeberry and scattered aspen commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this soil are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are also suitable practices where slopes are less than 15 percent. The main limitations for seeding are the difficulty of brush removal and some large stones. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass VIIe, nonirrigated. It is in Brushy Loam range site.

24—Cochetopa-Jerry loams, 12 to 25 percent slopes. This map unit is on mountainsides. Areas are irregular in shape and are 20 to 500 acres in size. The native vegetation is mainly brush and grasses. Elevation is 7,000 to 9,500 feet. The average annual precipitation is 19 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 50 percent Cochetopa loam and 40 percent Jerry loam.

Included in this unit are small areas of Bucklon, Inchau, and Lamphier loams. Also included are small areas of soils that are similar to these Cochetopa and Jerry soils but are moderately deep to bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Cochetopa soil is deep and well drained. It formed in alluvium and colluvium derived dominantly from sandstone and basalt. Typically, the upper part of the surface layer is dark grayish brown loam about 8 inches thick. The lower part is dark grayish brown loam about 11 inches thick. The upper 10 inches of the subsoil is dark grayish brown clay loam, and the lower 15 inches is yellowish brown clay. The substratum to a depth of 60 inches or more is grayish brown clay loam. In some areas the surface layer is cobbly loam.

Permeability of the Cochetopa soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high to very high.

The Jerry soil is deep and well drained. It formed in residuum and colluvium derived dominantly from shale. Typically, the upper part of the surface layer is dark grayish brown loam about 2 inches thick. The lower part is brown loam about 11 inches thick. The upper 21 inches of the subsoil is yellowish brown channery clay loam, and the lower 14 inches is light olive brown, calcareous channery clay loam. The substratum to a depth of 60 inches or more is light yellowish brown channery clay loam.

Permeability of the Jerry soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Gambel oak, Saskatoon serviceberry, elk sedge, mountain brome, slender wheatgrass, and Kentucky bluegrass. Smaller amounts of nodding brome, common snowberry, and chokecherry commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of steepness of slope and the presence of dense stands of brush.

This map unit is in capability subclass VIIe, nonirrigated. It is in Brushy Loam range site.

25—Colorow sandy loam. This deep, moderately well drained soil is on alluvial valley floors, flood plains, and low stream terraces. It formed in alluvium derived dominantly from sandstone. Slope is 0 to 3 percent. Areas are oval to elongated and are 20 to 100 acres. The native vegetation is mainly low brush, grasses, and willow. Elevation is 5,050 to 5,800 feet. The average annual precipitation is 8 to 10 inches, the average annual air temperature is 47 to 50 degrees F, and the average frost-free period is 105 to 130 days.

Typically, the surface layer is pale brown sandy loam 5 inches thick. The upper 27 inches of the underlying material is light brownish gray, stratified loam and fine sandy loam, the next 11 inches is pale brown, stratified fine sandy loam and loamy fine sand, and the lower part to a depth of 60 inches or more is pale brown, stratified sandy loam and sand. In some areas the surface layer is loam or loamy fine sand.

Included in this unit are small areas of Billings silty clay loam, Turley fine sandy loam, and Uffens loam. Also included are some areas of soils, between Yellow and Spring Creeks, that are more loamy than this Colorow soil and have lenses of clay loam to sand; small areas of soils that have a sandy overwash surface layer; and spots of saline soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Colorow soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The soil is subject to rare periods of flooding. The water table is at a depth of 4 to 6 feet.

This unit is used for irrigated hay and pasture, livestock grazing, and wildlife habitat.

The Colorow soil is well suited to hay and pasture. The main limitation is the hazard of flooding. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage.

Irrigation water can be applied by the border, corrugation, flooding, and sprinkler methods. Leveling helps to insure the uniform application of water. Because of the rare periods of flooding on this unit, special planning of irrigation systems is needed to prevent damage or destruction of the systems.

The potential plant community on this unit is mainly alkali sacaton, saltgrass, western wheatgrass, and sedges. Smaller amounts of willows, tall rabbitbrush, and fourwing saltbush commonly are also present in the potential plant community. The production of forage is limited by low precipitation. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

If rangeland seeding is used on this unit, the main limitation is low precipitation. The plants selected for

seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is poorly suited to urban development. The main limitations are the rare periods of flooding and depth to the water table.

This soil is suitable as a source of roadfill and topsoil.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated. It is in Sandy Saltdesert range site.

26—Cowdrey-Tampico loams, 15 to 50 percent slopes. This map unit is on mountainsides and toe slopes. Areas are irregular in shape and are 20 to 350 acres in size. The native vegetation is mainly coniferous forest and brush. Elevation is 7,800 to 9,000 feet. The average annual precipitation is 22 to 25 inches, the average annual air temperature is 36 to 39 degrees F, and the average frost-free period is 40 to 75 days.

This unit is 60 percent Cowdrey loam that has slopes of 30 to 50 percent and 30 percent Tampico loam that has slopes of 15 to 50 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Kamack and Lamphier loams and Miracle fine sandy loam. Also included are small areas of Rock outcrop and soils that are similar to the Cowdrey and Tampico soils but are moderately deep. Included areas make up about 10 percent of the total acreage.

The Cowdrey soil is deep and well drained. It formed in colluvium derived dominantly from sandstone and shale. Typically, the surface is covered with a mat of partially decomposed needles, twigs, cones, and leaves 2 inches thick. The surface layer is dark grayish brown loam 4 inches thick. The subsurface layer is pale brown loam 8 inches thick. The next layer is pale brown and pinkish gray loam 4 inches thick. The subsoil is light brown cobbly clay 18 inches thick. The substratum to a depth of 60 inches or more is light brown cobbly clay. The rock fragments are angular.

Permeability of the Cowdrey soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is very high.

The Tampico soil is deep and well drained. It formed in colluvium derived dominantly from interbedded red-bed sandstone and shale. Typically, the surface is covered with a mat of partially decomposed leaves and twigs 3 inches thick. The upper part of the surface layer is dark reddish gray loam about 11 inches thick, and the lower part is reddish gray loam about 4 inches thick. The upper 15 inches of the subsoil is reddish brown loam, and the lower 12 inches is reddish brown clay loam. The substratum to a depth of 60 inches or more is reddish brown cobbly clay loam. The rock fragments are angular.

Permeability of the Tampico soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high to very high.

Most areas of this unit are used as woodland and for wildlife habitat. A few areas are used for livestock grazing.

The potential plant community on the Cowdrey soil is mainly lodgepole pine and subalpine fir and some Douglas-fir and Engelmann spruce with an understory of kinnikinnick, Oregon-grape, mountain brome, and Colorado wildrye. The potential production of the native understory vegetation in normal years is about 100 pounds of air-dry vegetation per acre.

The site index for lodgepole pine ranges from 40 to 50. Woodland products such as corral poles, fenceposts, building poles, utility poles, and some sawtimber are available from this soil. Access is limited in the steeper areas, and conventional harvesting methods generally are restricted to areas that have slopes of less than 40 percent.

Proper design of road drainage systems and care in the placement of culverts help to control erosion. Spoil from excavations is subject to rill and gully erosion and to sloughing. Roads and landings can be protected from erosion by constructing water bars and by seeding cuts and fills.

The potential plant community on the Tampico soil is mainly mountain brome, elk sedge, slender wheatgrass, serviceberry, Gambel oak, and chokecherry. Smaller amounts of Colorado wildrye, snowberry, and aspen peavine commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

Slope limits access by livestock and results in overgrazing of the less sloping areas. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. The unit is poorly suited to rangeland seeding. It is limited mainly by slope in the steeper areas.

This map unit is in capability subclass VIIe, nonirrigated. About 60 percent of the unit is in lodgepole pine woodland site, and about 40 percent is in Brushy Loam range site.

27—Curecanti very cobbly loam, 1 to 8 percent slopes. This deep, well drained soil is on fans, toe slopes, and edges of terraces. It formed in glacial outwash. Areas are elongated and are 20 to 150 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 6,500 to 7,600 feet. The average annual precipitation is 17 to 20 inches, the average annual air

temperature is 40 to 44 degrees F, and the average frost-free period is 75 to 105 days.

Typically, the surface layer is dark brown very cobbly loam 9 inches thick. The upper part of the subsoil is brown very cobbly sandy clay loam 7 inches thick, and the lower part is brown very cobbly sandy loam 8 inches thick. The substratum to a depth of 60 inches or more is brown very cobbly loamy sand.

Included in this unit are small areas of Delson and Perma soils, Redrob Variant loam, and Shawa and Work loams. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Curecanti soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used as a source of roadfill.

The potential plant community on this unit is mainly western wheatgrass, prairie junegrass, needleandthread, big sagebrush, bluebunch wheatgrass, and Douglas rabbitbrush. Smaller amounts of Indian ricegrass, bitterbrush, and Saskatoon serviceberry commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 900 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

The suitability of this unit for rangeland seeding is poor. The main limitations are the cobbly surface layer and the narrow width of the areas of the unit.

This map unit is in capability subclasses IVe, irrigated, and VIe, nonirrigated. It is in Loamy Slopes range site.

28—Delson-Perma complex, 3 to 65 percent slopes. This map unit is on fans, mountainsides, uplands, and benches. Areas are elongated and are 20 to 350 acres. The native vegetation is mainly brush and grasses. Elevation is 7,000 to 7,800 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 39 to 41 degrees F, and the average frost-free period is 80 to 105 days.

This unit is 55 percent Delson stony loam that has slopes of 3 to 25 percent and 30 percent Perma cobbly loam that has slopes of 15 to 65 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Clayburn, Lamphier, Tampico, and Winnemucca loams. Also included are small areas of soils that are similar to these Delson and Perma soils but are moderately deep to bedrock, areas of soils that have a stony surface layer, and Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Delson soil is deep and well drained. It formed in alluvium derived dominantly from basaltic and sedimentary material. Typically, the surface layer is dark brown stony loam 12 inches thick. The upper 4 inches of the subsoil is reddish brown stony clay loam, and the lower 24 inches is reddish brown stony clay. The substratum to a depth of 60 inches or more is reddish brown stony clay loam.

Permeability of the Delson soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is slight.

The Perma soil is deep and well drained. It formed in alluvium and colluvium derived dominantly from basaltic material. Typically, the surface layer is brown cobbly loam 8 inches thick. The upper 7 inches of the subsoil is brown very cobbly loam, and the lower 15 inches is grayish brown very cobbly loam. The substratum to a depth of 60 inches or more is grayish brown very cobbly sandy loam.

Permeability of the Perma soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high to very high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few of the less sloping areas of the Delson soil are used for irrigated pasture.

The potential plant community on this unit is mainly bluebunch wheatgrass, Letterman needlegrass, slender wheatgrass, western wheatgrass, big sagebrush, and Saskatoon serviceberry. Smaller amounts of Indian ricegrass, chokecherry, common snowberry, and some Gambel oak commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are also suitable practices where slopes are less than 15 percent. The main limitation for seeding is large stones on the surface. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should

meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for hay and pasture, the main limitations are stones on the surface and steepness of slope. The use of equipment is also limited by stones on the surface and by slope. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage.

This map unit is in capability subclass VIe. It is in Stony Loam range site.

29—Dollard silty clay loam, 3 to 8 percent slopes. This moderately deep, well drained soil is on foot slopes and low ridges. It formed in clayey residuum derived dominantly from shale. The native vegetation is mainly grasses and low shrubs. Elevation is 5,800 to 6,800 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is very pale brown silty clay loam 3 inches thick. The next layer is light yellowish brown silty clay loam 8 inches thick. The underlying material is yellow to gray silty clay loam 15 inches thick. Clayey shale is at a depth of 26 inches. Depth to shale ranges from 20 to 40 inches. The soil is calcareous throughout.

Included in this unit are small areas of Abor clay loam, Kobar silty clay loam, and Moyerson stony clay loam. The Abor soil is in the higher lying areas on ridge crests, and the Moyerson soil is in the higher lying areas on foot slopes. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Dollard soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used for nonirrigated small grain and irrigated hay and pasture. A few areas are used for limited livestock grazing and wildlife habitat.

This unit is suited to nonirrigated and irrigated crops. If the unit is used for nonirrigated crops, the main limitations are a short growing season, slow permeability, and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crusting of the surface and compaction of the soil can be reduced by returning crop residue to the soil.

If this unit is used for irrigated hay and pasture, the main limitations are slow permeability, shallow rooting depth, and a short growing season. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist.

Irrigation water needs to be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion. Leveling helps to insure the uniform application of water. Because of slope, soil depth, and slow permeability, sprinkler or flood irrigation is best suited to this unit. Irrigated hay and pasture respond to applications of nitrogen and phosphorus.

Grazing when the soil in this unit is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

The potential plant community on this unit is mainly western wheatgrass, prairie junegrass, big sagebrush, and low rabbitbrush. Smaller amounts of Indian ricegrass and milkvetch commonly are also present in the potential plant community. The production of forage is limited by a short growing season, low precipitation, and shallow rooting depth. The average annual production of air-dry vegetation is about 800 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in the unit has drained sufficiently and is firm enough to withstand trampling by livestock. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

If the range is in poor condition, seeding is also a suitable practice where slopes are less than 15 percent. The main limitation for seeding is low precipitation. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass IVe. It is in Clayey Foothills range site.

30—Dollard silty clay loam, 8 to 15 percent slopes. This moderately deep, well drained soil is on foot slopes and low ridges. It formed in clayey residuum derived dominantly from shale. The native vegetation is mainly grasses and low shrubs. Elevation is 5,800 to 6,800 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is very pale brown silty clay loam 3 inches thick. The next layer is light yellowish brown silty clay loam 8 inches thick. The underlying material is yellow to gray silty clay loam 15 inches thick. Clayey shale is at a depth of 26 inches. Depth to shale ranges from 20 to 40 inches. The soil is calcareous throughout.

Included in this unit are small areas of Abor clay loam, Kobar silty clay loam, and Moyerson stony clay loam. The Abor soil is in the higher lying areas on ridge crests, and the Moyerson soil is in the higher lying areas on foot slopes. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Dollard soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high to very high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for nonirrigated small grain.

The potential plant community on this unit is mainly western wheatgrass, prairie junegrass, big sagebrush, and low rabbitbrush. Smaller amounts of Indian ricegrass and milkvetch commonly are also present in the potential plant community. The production of forage is limited by rapid runoff and restricted rooting depth. The average annual production of air-dry vegetation is about 800 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in the unit has drained sufficiently and is firm enough to withstand trampling by livestock. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

The suitability of this unit for rangeland seeding is fair. The main limitations are low precipitation, slow permeability, and rapid runoff. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for nonirrigated small grain, the main limitations are low precipitation, slow permeability, and rapid runoff. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Compaction and excessive cloddiness occur if the soil in this unit is cultivated when it is too moist. Excessive cultivation can result in the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry.

Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crusting of the surface and compaction of the soil can be reduced by returning crop residue to the soil.

This map unit is in capability subclass IVe, nonirrigated. It is in Clayey Foothills range site.

31—Dollard silty clay loam, 15 to 40 percent slopes. This moderately deep, well drained soil is on foothills and ridges. It formed in clayey residuum derived dominantly from shale. Areas are long and narrow and are 30 to 100 acres. The native vegetation is mainly grasses and low shrubs. Elevation is 5,800 to 6,800 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is very pale brown silty clay loam 2 inches thick. The next layer is light yellowish brown silty clay loam 5 inches thick. The underlying material is yellowish brown silty clay loam about 17 inches thick. Clayey shale is at a depth of about 24 inches. Depth to shale ranges from 20 to 40 inches. The soil is calcareous throughout.

Included in this unit are small areas of Moyerson stony clay loam and areas of Badland.

Permeability of this Dollard soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, prairie junegrass, big sagebrush, and low rabbitbrush. Smaller amounts of Indian ricegrass and milkvetch commonly are also present in the potential plant community. The production of forage is limited by slow permeability, rapid runoff, and restricted rooting depth. The average annual production of air-dry vegetation is about 650 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of steepness of slope, rapid runoff, and slow permeability. Grazing should be delayed until the soil in this unit is firm

and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This map unit is in capability subclass VIIe, nonirrigated. It is in Clayey Foothills range site.

32—Fluvaquents, frequently flooded. This map unit is on alluvial valley floors and flood plains and in oxbows, swales, and old river channels along major rivers and streams. It formed in mixed alluvium derived dominantly from sedimentary and basaltic material. Slope is 0 to 3 percent. Areas are elongated and are 5 to 30 acres. The native vegetation is mainly willows, water-tolerant grasses, and some cottonwood trees. Cattails are in some of the low-lying oxbows. Elevation is 5,100 to 7,400 feet. The average annual precipitation is 8 to 20 inches, the average annual air temperature is 38 to 50 degrees F, and the average frost-free period is 45 to 120 days.

These soils are deep and poorly drained. They consist of thin layers of highly stratified clay loam to sand underlain by very gravelly and cobbly sand.

Included in this unit are small areas of Redrob loam, Redrob Variant loam, Colorow sandy loam, and Trembles loam, wet.

Permeability is very rapid. Available water capacity is moderate to high. The rooting depth is adequate to support only water-tolerant vegetation. A seasonal high water table fluctuates between depths of 6 and 36 inches in spring and summer. Most of this unit is subject to periods of flooding in spring.

Use of this unit is limited to some livestock grazing after the periods of flooding in spring and to habitat for some waterfowl, muskrat, and beaver.

This map unit is in capability subclass VIIw. It is in Riverbottom range site.

33—Forelle loam, 3 to 8 percent slopes. This deep, well drained soil is on terraces and uplands. It formed in eolian and alluvial material derived dominantly from sedimentary rock. Areas are irregular in shape and are 20 to 600 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is pale brown loam 4 inches thick. The upper 12 inches of the subsoil is yellowish brown clay loam, and the lower 5 inches is light yellowish brown loam. The substratum to a depth of 60 inches or more is very pale brown loam.

Included in this unit are small areas of Patent loam, Piceance fine sandy loam, Work loam, Yamac loam, and Zoltay clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Forelle soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used for nonirrigated and irrigated crops, livestock grazing, and wildlife habitat. A few areas are used for urban development and as a source of topsoil.

This unit is well suited to nonirrigated small grain and irrigated hay and pasture. Wheat is the main nonirrigated crop.

If this unit is used for small grain, the main limitations are the hazard of erosion, a short growing season, and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Soil blowing can also be reduced by keeping the soil rough and cloddy when it is not protected by vegetation. On long slopes, chiseling the stubble in fall slows runoff and reduces soil loss in years when the snow melts rapidly while the soil is still frozen. Chiseling also promotes better aeration.

This unit is well suited to hay and pasture. The main limitations are a short growing season, the hazard of water erosion, and low precipitation. Use of nitrogen, phosphorus, and manure fertilizer promotes good growth of forage plants. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Irrigation water can be applied by the sprinkler, corrugation, and controlled flooding methods. Leveling helps to insure the uniform application of water.

The potential plant community on this unit is mainly western wheatgrass, prairie junegrass, big sagebrush, Douglas rabbitbrush, streambank wheatgrass, and needleandthread. The production of forage is limited by a short growing season and low precipitation. The average annual production of air-dry vegetation is about 800 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. If the range is in poor condition, seeding is also a suitable practice where slopes are less than 15 percent. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for urban development, the main limitations are low soil strength, the potential for shrinking and swelling, and the hazard of frost action.

The possibility of settlement can be minimized by compacting the building site before construction is begun. If buildings are constructed on this unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass IVe. It is in Rolling Loam range site.

34—Forelle loam, 8 to 15 percent slopes. This deep, well drained soil is on terraces and uplands. It formed in eolian and alluvial material derived dominantly from sedimentary rock. Areas are elongated and are 20 to 250 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is pale brown loam 4 inches thick. The upper 12 inches of the subsoil is yellowish brown clay loam, and the lower 5 inches is light yellowish brown loam. The substratum to a depth of 60 inches or more is very pale brown loam.

Included in this unit are small areas of Dollard silty clay loam, Patent loam, Work loam, and Zoltay clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Forelle soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high.

This unit is used for nonirrigated crops, livestock grazing, and wildlife habitat.

If this unit is used for nonirrigated crops, the main limitations are the hazard of erosion, a short growing season, and low precipitation. Wheat is the main nonirrigated crop. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Soil blowing can also be controlled by keeping the soil rough and cloddy when it is not protected by vegetation. On long slopes, chiseling the stubble in fall slows runoff and reduces soil loss in years when the snow melts rapidly while the soil is still frozen. Chiseling also promotes better aeration. The more steeply sloping areas are poorly suited to cultivation.

The potential plant community on this unit is mainly western wheatgrass, prairie junegrass, big sagebrush, Douglas rabbitbrush, streambank wheatgrass, and needleandthread. The production of forage is limited by a short growing season and low precipitation. The average annual production of air-dry vegetation is about 750 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. If the range is in poor condition, seeding is also a suitable practice where slopes are less than 15 percent. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for urban development, the main limitations are the potential for shrinking and swelling, the hazard of frost action, and slope.

This map unit is in capability subclass IVe, nonirrigated. It is in Rolling Loam range site.

35—Gaynor-Midway silty clay loams, dry, 2 to 25 percent slopes. This map unit is on low hills, ridges, and knolls. Areas are irregular in shape and are 200 to 1,000 acres in size. The native vegetation is mainly salt-tolerant desert shrubs and grasses. Elevation is 5,200 to 5,800 feet. The average annual precipitation is 10 to 13 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 105 to 130 days.

This unit is 50 percent Gaynor silty clay loam that has slopes of 2 to 15 percent and 35 percent Midway silty clay loam that has slopes of 2 to 25 percent. The Gaynor soil is on ridges, and the Midway soil is on the steeper side slopes and on the crests of knolls. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Glenton sandy loam, Killpack silty clay loam, and Walknolls channery sandy loam. The Walknolls soil is on benches. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Gaynor soil is moderately deep and well drained. It formed in calcareous residuum derived from shale. Typically, the upper part of the surface layer is pale brown silty clay loam about 2 inches thick, and the lower part is very pale brown silty clay about 6 inches thick. The next layer is pale brown silty clay 13 inches thick. The underlying material is light yellowish brown silty clay that has some gypsum crystals and is 8 inches thick. Shale is at a depth of 29 inches. Depth to shale ranges from 20 to 40 inches. The soil has cracks as much as 1 1/2 inches wide and 20 inches deep when dry. It is calcareous throughout.

Permeability of the Gaynor soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

The Midway soil is shallow and well drained. It formed in calcareous residuum derived from shale. Typically, the surface layer is light yellowish brown silty clay loam 4 inches thick. The next layer is pale brown silty clay loam 5 inches thick. The underlying material is grayish brown silty clay loam that has seams and nests of gypsum crystals and is 4 inches thick. Shale is at a depth of 13 inches. Depth to shale ranges from 10 to 20 inches. The soil is calcareous throughout.

Permeability of the Midway soil is slow. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly galleta, salina wildrye, bottlebrush squirreltail, winterfat, shadscale, and spiny horsebrush. Smaller amounts of budsage, Indian ricegrass, and bluegrass commonly are also present in the potential plant community. The production of forage is limited by the slow permeability and low available water capacity. The average annual production of air-dry vegetation is about 500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of the low precipitation, restricted rooting depth, and slope.

This unit is poorly suited to urban development. The main limitations are shrink-swell potential, depth to rock, and slope.

This map unit is in capability subclass VIe, nonirrigated. It is in Silty Saltdesert range site.

36—Glendive fine sandy loam. This deep, well drained soil is along drainageways on alluvial valley floors. It formed in alluvium. Areas are long and narrow and are 20 to 150 acres in size. Slope is 2 to 4 percent. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 14 to 17 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is pale brown fine sandy loam 6 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, stratified fine sandy loam that has thin lenses of loamy fine sand to sandy clay loam. The soil is calcareous throughout. In some areas the surface layer is channery fine sandy loam.

Included in this unit are small areas of Barcus channery loamy sand and Havre loam. The Barcus soil is on fans, and the Havre soil is in swales. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Glendive soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The soil is subject to rare periods of flooding.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for irrigated pasture.

The potential plant community on this unit is mainly basin wildrye, western wheatgrass, Indian ricegrass, and big sagebrush. Smaller amounts of fourwing saltbush and rubber rabbitbrush commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

If the range vegetation is seriously deteriorated, seeding is needed. The main limitations for seeding are low precipitation and droughtiness of the soil. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

This unit is used extensively by mule deer as winter range.

This unit is well suited to hay and pasture. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage. Leveling helps to insure the uniform application of water.

This unit is poorly suited to urban development. The main limitation is the hazard of flooding.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated. It is in Foothills Swale range site.

37—Glenton sandy loam, 1 to 6 percent slopes. This deep, well drained soil is along intermittent drainageways and on terraces and alluvial fans. It formed in calcareous alluvium derived from sandstone. Areas are long and narrow and are 20 to 200 acres. The native vegetation is mainly desert shrubs and grasses. Elevation is 5,100 to 5,700 feet. The average annual precipitation is 8 to 10 inches, the average annual air temperature is 47 to 50 degrees F, and the average frost-free period is 105 to 130 days.

Typically, the surface layer is pale brown sandy loam 10 inches thick. The underlying material to a depth of 60 inches or more is mainly pale brown, stratified fine sandy loam and sandy loam. In some areas the surface layer is channery or flaggy sandy loam.

Included in this unit are small areas of Walknolls channery sandy loam and Rock outcrop. Also included are small areas of Turley fine sandy loam and Uffens loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Glenton soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The soil is subject to occasional periods of flooding.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly galleta, bottlebrush squirreltail, Indian ricegrass, and big sagebrush. Smaller amounts of rubber rabbitbrush and greasewood commonly are also present in the potential plant community. The production of forage is limited by low precipitation. The average annual production of air-dry vegetation is about 500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

The suitability of this unit for rangeland seeding is poor. The main limitations are low precipitation and moderate available water capacity.

This unit is limited for livestock watering ponds and other water impoundments because of the seepage potential.

This map unit is in capability subclass VIe, nonirrigated. It is in Alkaline Slopes range site.

38—Guben loam, 0 to 3 percent slopes. This deep, well drained soil is on upland benches and terrace edges. It formed in a thin eolian deposit over alluvium and glacial outwash. Areas are oval to elongated and are 20 to 50 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is grayish brown loam 6 inches thick. The upper 5 inches of the subsoil is brown loam, and the lower 4 inches is pale brown gravelly loam. The substratum to a depth of 60 inches or more is white very gravelly loam and very cobbly loam. The soil is calcareous throughout. In some areas the surface layer is sandy loam, gravelly sandy loam, or cobbly sandy loam.

Included in this unit are small areas of Forelle loam, Work loam, and Zoltay clay loam. Also included are small areas of soils that are similar to this Guben soil but are moderately deep to bedrock.

Permeability of this Guben soil is moderate. Available water capacity is moderately low. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight.

This unit is used mainly for irrigated hay and pasture, livestock grazing, and wildlife habitat. It is also used as a source of roadfill and gravel.

This unit is well suited to hay and pasture. The main limitation is moderately low available water capacity. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Irrigation water can be applied by the border or sprinkler methods. Because the soil in this unit is droughty, applications of irrigation water should be light and frequent.

Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage. Annual applications of nitrogen and phosphorus fertilizer are needed to maintain production of high-quality irrigated pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, prairie junegrass, and big sagebrush. Smaller amounts of bluebunch wheatgrass and low rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season and low available water capacity. The average annual production of air-dry vegetation is about 800 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Brush management improves

deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is suitable as a source of roadfill and gravel.

This map unit is in capability subclasses IIIe, irrigated, and IIIc, nonirrigated. It is in Rolling Loam range site.

39—Guben loam, 3 to 8 percent slopes. This deep, well drained soil is on upland benches and terrace edges. It formed in a thin mantle of eolian silt and fine sand underlain by alluvium and glacial outwash. Areas are irregular and elongated in shape and are 20 to 100 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is grayish brown loam 6 inches thick. The upper 5 inches of the subsoil is brown loam, and the lower 4 inches is pale brown gravelly loam. The substratum to a depth of 60 inches or more is white very gravelly loam and very cobbly loam. The soil is calcareous throughout. In some areas the surface layer is sandy loam, gravelly sandy loam, or cobbly sandy loam.

Included in this unit are small areas of Forelle and Work loams and Zoltay clay loam. Also included are small areas of soils that are similar to this Guben soil but are moderately deep to bedrock.

Permeability of the Guben soil is moderate. Available water capacity is moderately low. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is moderate.

This unit is used mainly for irrigated hay and pasture, livestock grazing, and wildlife habitat. It is also used as a source of roadfill and gravel.

If this unit is used for irrigated hay and pasture, the main limitations are low available water capacity and slope. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Seedbed preparation should be on the contour or across the slope where practical.

Sprinkler irrigation is the most suitable method of applying water. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Irrigation water needs to be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion.

Grazing when the soil in this unit is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage. Annual applications of nitrogen and phosphorus fertilizer are needed to maintain production of high-quality irrigated pasture.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, prairie junegrass, and big sagebrush. Smaller amounts of bluebunch wheatgrass and low rabbitbrush commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 700 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is suitable as a source of roadfill and gravel.

This map unit is in capability subclass IVe. It is in Rolling Loam range site.

40—Hagga loam. This deep, poorly drained soil is on flood plains and alluvial valley floors. It formed in alluvium derived dominantly from sandstone and shale. Slope is 0 to 5 percent. Areas are long and narrow and are 20 to 300 acres. The native vegetation is mainly water-tolerant grasses. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 15 to 16 inches, the average annual air temperature is 43 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is light brownish gray loam 5 inches thick. Below this to a depth of 60 inches or more is stratified silty clay loam to loamy fine sand. The color is variable because of wetness and stratification.

Included in this unit are small areas of Barcus channery loamy sand, Glendive fine sandy loam, Havre loam, and Shawa loam. Also included are small saline spots and small areas of soils that have a clay loam surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Hagga soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more for water-tolerant plants, but it is

limited to depths between 10 and 20 inches for non-water-tolerant plants. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 12 to 24 inches in spring and early in summer. This soil is subject to brief periods of flooding in spring and summer.

This unit is used for pasture, native hay, and wildlife habitat.

This unit is well suited to hay and pasture. The main limitations are wetness and the seasonal high water table. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Excessive water on the surface can be removed by open surface drainage.

The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Leaching of the salts from the surface layer is limited by the high water table. Drainage and irrigation water management reduce the concentration of salts. Salt-tolerant species are most suitable for planting.

For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage.

The potential plant community on this unit is mainly western wheatgrass, Nebraska sedge, slender wheatgrass, and basin wildrye. Tufted hairgrass, rushes, and yarrow commonly are also present in the potential plant community. The production of forage is limited by the short growing season, wetness, and in places, salinity. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

If the range vegetation is seriously deteriorated, seeding is needed. The main limitations are wetness and the seasonal high water table. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Plants that tolerate wetness should be seeded.

Other management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in this unit has drained sufficiently and is firm enough to withstand trampling by livestock.

This map unit is in capability subclass Vw. It is in Swale Meadow range site.

41—Havre loam, 0 to 4 percent slopes. This deep, well drained soil is on flood plains and low stream terraces. It formed in calcareous alluvium. Areas are long and narrow and are 40 to 400 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 14 to 17 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is light brownish gray loam 21 inches thick. The upper 19 inches of the underlying material is stratified, light gray loam and silty clay loam, and the lower part to a depth of 60 inches or more is stratified loam and sandy loam. In some areas the surface layer is clay loam or fine sandy loam.

Included in this unit are small areas of Barcus channery loamy sand, Glendive fine sandy loam, Hagga loam, and Tisworth fine sandy loam. The Barcus soil is on the edge of steeper areas of outwash, and the Hagga soil is in swales. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Havre soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. Small areas of this soil are subject to brief periods of flash flooding late in spring and in summer.

This unit is used for livestock grazing, irrigated crops, and wildlife habitat.

The potential plant community on this unit is mainly basin wildrye, western wheatgrass, streambank wheatgrass, bluegrasses, and big sagebrush. Smaller amounts of rubber rabbitbrush, fourwing saltbush, and bottlebrush squirreltail commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

Range seeding is also suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. For successful seeding, prepare a seedbed and drill in the seed.

This unit is well suited to hay and pasture. It has few limitations. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation.

Grazing when the soil in this unit is too moist results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage. Annual applications of nitrogen and phosphorus fertilizer are needed to maintain production of high-quality irrigated pasture.

Irrigation water can be applied by the border, corrugation, controlled flooding, and sprinkler methods. Leveling helps to insure the uniform application of water.

If this unit is used for irrigated small grain, the main limitations are the short growing season and availability of irrigation water. In summer, irrigation is needed for maximum production of most crops. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize the leaching of plant nutrients. For the efficient application and removal of irrigation water, leveling is needed in sloping areas. Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus.

Most areas of this unit are used extensively as winter range for mule deer.

If this unit is used for urban development, sanitary facilities, and roads, special designs are needed to compensate for the hazard of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load.

This map unit is in capability subclasses IIIe, irrigated, and IIIc, nonirrigated. It is in Foothill Swale range site.

42—Irigul channery loam, 5 to 50 percent slopes. This shallow, well drained soil is on ridges and mountainsides. It formed in residuum derived from sandstone and hard shale. Areas are oval to oblong and are 20 to 200 acres. The native vegetation is mainly grasses and shrubs. Elevation is 7,600 to 8,700 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the surface layer is grayish brown channery loam 5 inches thick. The underlying material is brown extremely channery loam 7 inches thick. Hard sandstone is at a depth of 12 inches. Depth to hard sandstone or shale is 10 to 20 inches.

Included in this unit are small areas of Absarokee, Delson, and Nagitsy channery loams, Parachute loam, and soils that are similar to this Irigul soil but are moderately deep or very shallow. Also included are small areas of Rock outcrop on south-facing slopes of ridges. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Irigul soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is very high.

This unit is used for limited livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly beardless wheatgrass, western wheatgrass, serviceberry, big sagebrush, and low rabbitbrush. Smaller amounts of prairie junegrass, bluegrass, and bitterbrush commonly are also present in the potential plant community. The production of forage is limited by the shallow rooting depth and a short growing season. The average annual production of air-dry vegetation is about 900 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are also suitable practices where slopes are less than 15 percent. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. The main limitations for seeding are shallow soil depth and the short growing season. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. For successful seeding, prepare a seedbed and drill in the seed.

This unit is used extensively as winter range for elk and mule deer.

This map unit is in capability subclass VIIe, nonirrigated. It is in Loamy Slopes range site.

43—Irigul-Parachute complex, 5 to 30 percent slopes. This map unit is on ridges and mountainsides. Areas are irregular in shape and are 20 to 250 acres in size. The native vegetation is mainly grasses and shrubs. Elevation is 7,600 to 8,500 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 60 percent Irigul channery loam and 30 percent Parachute loam. The Irigul soil is mainly in convex areas, and the Parachute soil is in slightly

concave areas. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Castner channery loam, Rhone loam, and Veatch channery loam. Also included are small areas of Starman and Vandamore soils and Rock outcrop.

The Irigul soil is shallow and well drained. It formed in residuum derived from sandstone and hard shale. Typically, the surface layer is grayish brown channery loam 5 inches thick. The underlying material is brown extremely channery loam 7 inches thick. Hard sandstone is at a depth of 12 inches. Depth to hard sandstone or shale is 10 to 20 inches.

Permeability of the Irigul soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is slight to high.

The Parachute soil is moderately deep and well drained. It formed in residuum derived dominantly from sandstone. Typically, the surface layer is grayish brown loam 4 inches thick. The upper 20 inches of the subsoil is grayish brown loam and channery loam, and the lower 8 inches is pale brown very channery loam. The substratum is very pale brown extremely channery sandy loam 6 inches thick. Sandstone is at a depth of 38 inches. Depth to sandstone or shale ranges from 20 to 40 inches.

Permeability of the Parachute soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Irigul soil is mainly beardless wheatgrass, western wheatgrass, serviceberry, and big sagebrush. Smaller amounts of prairie junegrass and bitterbrush commonly are also present in the potential plant community. The production of forage is limited by restricted rooting depth and a short growing season. The average annual production of air-dry vegetation is about 900 pounds per acre.

The potential plant community on the Parachute soil is mainly Idaho fescue, Letterman needlegrass, Columbia needlegrass, and big sagebrush. Smaller amounts of serviceberry and low rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season and low available water capacity. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

If this unit is seeded, the main limitations are slope, shallow rooting depth, and a short growing season. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. For successful seeding, prepare a seedbed and drill in the seed.

This unit is used extensively as winter range for elk and mule deer.

This map unit is in capability subclass VIIe, nonirrigated. The Irigul soil is in Loamy Slopes range site, and the Parachute soil is in Mountain Loam range site.

44—Jerry loam, 12 to 45 percent slopes. This deep, well drained soil is on mountainsides. It formed in residuum and colluvium derived dominantly from shale. Areas are irregular in shape and are 20 to 500 acres in size. The native vegetation is mainly brush and grasses. Elevation is 7,000 to 9,500 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the upper part of the surface layer is dark grayish brown loam about 2 inches thick. The lower part is brown loam about 11 inches thick. The upper 21 inches of the subsoil is yellowish brown channery clay loam, and the lower 14 inches is light olive brown channery clay loam. The substratum to a depth of 60 inches or more is light yellowish brown channery clay loam that has thin, discontinuous lenses of weathered sandstone. In some areas the surface layer is fine sandy loam or sandy loam.

Included in this unit are small areas of Burnette, Owen Creek, and Rhone loams and Thornburgh channery loam. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Jerry soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is high to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Gambel oak, serviceberry, mountain brome, and elk sedge. Smaller amounts of Letterman needlegrass, western wheatgrass, slender wheatgrass, bluegrasses, chokecherry, and big sagebrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock

grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

This unit is used extensively year-round as a source of food and shelter for elk and mule deer.

This unit is poorly suited to urban development. The main limitations are the potential for shrinking and swelling, slope, and the hazard of landsliding. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass VIIe, nonirrigated. It is in Brushy Loam range site.

45—Jerry-Thornburgh-Rhone complex, 8 to 65 percent slopes. This map unit is on mountainsides, ridges, and side slopes. Areas are irregular in shape and are 100 to 1,200 acres in size. Elevation is 7,000 to 9,000 feet. The average annual precipitation is 20 to 25 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 35 percent Jerry loam that has slopes of 8 to 45 percent, 30 percent Thornburgh channery loam that has slopes of 8 to 65 percent, and 20 percent Rhone loam that has slopes of 8 to 50 percent. The Jerry soil commonly has slopes of less than 15 percent, and the Rhone soil generally is on north-facing slopes. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Burnette loam, Blazon channery loam, Lamphier loam, Mergel channery loam, Owen Creek loam, Redthayne channery loam, and Rentsac channery loam. Also included are small areas of a soil that is more than 35 percent rock fragments and small areas of Rock outcrop. Rock outcrop consists of ridges and small exposed bluffs. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Jerry soil is deep and well drained. It formed in alluvium and colluvium derived dominantly from shale. Typically, the surface layer is brown loam 5 inches thick. The upper 8 inches of the subsoil is yellowish brown channery clay loam, and the lower 22 inches is light olive brown channery clay loam. The substratum to a depth of 60 inches or more is light yellowish brown channery clay loam. Weathered bedrock is at a depth of 5 to 8 feet.

Permeability of the Jerry soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate to very high.

The Thornburgh soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from sandstone. Typically, the upper part of the surface layer is very dark grayish brown channery loam about 5 inches thick. The lower part is dark grayish brown channery loam about 9 inches thick. The subsoil is brown very channery loam 13 inches thick. The substratum to a depth of 60 inches or more is pale brown very channery sandy loam.

Permeability of the Thornburgh soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to very high.

The Rhone soil is deep and well drained. It formed in colluvium and residuum derived dominantly from sandstone and hard shale. Typically, the upper part of the surface layer is dark grayish brown loam 24 inches thick. The lower part is grayish brown very channery loam 16 inches thick. The underlying material is brown very channery loam 10 inches thick. Sandstone is at a depth of 50 inches. Depth to sandstone ranges from 40 to 60 inches.

Permeability of the Rhone soil is moderate. Available water capacity is high. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Gambel oak, serviceberry, mountain brome, elk sedge, western wheatgrass, and bluegrasses. Smaller amounts of snowberry, Letterman needlegrass, slender wheatgrass, chokecherry, and big sagebrush commonly are also present in the potential plant community. Small patches of stunted aspen are on the north-facing slopes. The production of forage is limited by a short growing season and steepness of slope. The average annual production of air-dry vegetation is about 2,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are suitable practices where slopes are less than 15 percent. The main limitations for seeding are steepness of slope, a short growing season, and competition from brush. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. For successful seeding, prepare a seedbed and drill in the seed.

This unit is used extensively year-round as a source of food and shelter for elk, mule deer, and grouse.

This unit is poorly suited to urban development. The main limitations are the potential for shrinking and

swelling, slow permeability, steepness of slope, and the hazard of landsliding.

This map unit is in capability subclass VIIe, nonirrigated. It is in Brushy Loam range site.

46—Kinnear fine sandy loam, 1 to 5 percent slopes. This deep, well drained soil is on fans and upland terraces. It formed in calcareous alluvial and eolian material. Areas are irregular in shape and are 20 to 300 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 5,200 to 5,800 feet. The average annual precipitation is 8 to 11 inches, the average annual air temperature is 47 to 50 degrees F, and the average frost-free period is 105 to 130 days.

Typically, the surface layer is pale brown fine sandy loam 5 inches thick. The subsoil is pale brown loam 12 inches thick. The upper 18 inches of the substratum is very pale brown, highly calcareous loam, and the lower part to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is very fine sandy loam, loam, or silt loam. The soil is calcareous throughout.

Included in this unit are small areas of Nihill channery sandy loam in the higher lying areas and Cliffdown gravelly loam along the terrace edges. Also included are small areas of soils that have slopes of more than 5 percent and small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Kinnear soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the surface is disturbed and is not protected.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for urban development and as a source of topsoil and roadfill.

Where water for irrigation is available, this unit is well suited to irrigated crops and hay and pasture.

The potential plant community on this unit is mainly shadscale, big sagebrush, galleta, winterfat, Indian ricegrass, and Douglas rabbitbrush. Smaller amounts of needleandthread, gardner saltbrush, and western wheatgrass commonly are also present in the potential plant community. The production of forage is limited by low precipitation in summer. The average annual production of air-dry vegetation is about 650 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is well suited to urban development. It has few limitations. Excavation for houses and access roads in places exposes material that is highly susceptible to soil blowing. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

This unit is suitable as a source of topsoil and roadfill.

This map unit is in capability subclasses IIIe, irrigated, and IVc, nonirrigated. It is in Loamy Saltdesert range site.

47—Kobar silty clay loam, 0 to 3 percent slopes. This deep, well drained soil is on alluvial valley floors and on fans. It formed in calcareous alluvium derived from shale. Areas generally are long and narrow and are 20 to 300 acres. The vegetation in areas not cultivated is mainly low shrubs and grasses. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is grayish brown silty clay loam about 3 inches thick. The next layer is grayish brown silty clay loam about 9 inches thick. The upper 31 inches of the underlying material is light brownish gray silty clay that has some gypsum crystals, and the lower part to a depth of 60 inches or more is light gray silty clay. In some areas the surface layer is clay loam or silty clay.

Included in this unit are small areas of Absher loam, Dollard silty clay loam, Havre loam, Patent loam, and Tisworth fine sandy loam. Also included are small areas of soils that are similar to this Kobar soil but are severely gullied. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Kobar soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight.

This unit is used mainly as irrigated and nonirrigated cropland and for livestock grazing. It is also used for urban development and wildlife habitat.

This unit is well suited to hay and pasture. The main limitations are slow permeability and a short growing season. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Grazing when the soil in this unit is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the

pasture in good condition and to protect the soil from erosion.

If this unit is used for irrigated crops, the main limitation is slow permeability. In summer, irrigation is needed for maximum production of most crops. Irrigation water can be applied by the border, corrugation, and furrow methods. The method used generally is governed by the crop grown. Water needs to be applied at a slow rate over a long period to insure that the root zone is properly wetted. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Leveling helps to insure the uniform application of water. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist. Annual applications of nitrogen and phosphorus fertilizer are needed to maintain production of high quality irrigated pasture.

If this unit is used for nonirrigated small grain, the main limitations are slow permeability and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Tillage should be kept to a minimum. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist. Crops respond to small applications of nitrogen fertilizer.

The potential plant community on this unit is mainly western wheatgrass, Letterman needlegrass, muttongrass, slender wheatgrass, and big sagebrush. Smaller amounts of serviceberry, rabbitbrush, and greasewood commonly are also present in the potential plant community. The production of forage is limited by slow permeability and strong alkalinity. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in this unit has drained sufficiently and is firm enough to withstand trampling by livestock. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

Range seeding is also suitable if the range is in poor condition. The main limitations for seeding are low precipitation and slow permeability. For successful seeding, prepare a seedbed and drill in the seed. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for urban development, the main limitations are the potential for shrinking and swelling and slow permeability. Because standard septic tank absorption fields will not function properly on the soil in this unit, other sewage systems or designs are needed. Buildings and roads should be designed to offset the limited ability of the soil to support a load. The effects of shrinking and swelling can be reduced by maintaining a constant moisture content around the foundation and by backfilling excavations with material that has low shrink-swell potential.

This map unit is in capability subclasses IIIe, irrigated, and IIIc, nonirrigated. It is in Deep Clay Loam range site.

48—Kobar silty clay loam, 3 to 8 percent slopes. This deep, well drained soil is on alluvial valley floors and on fans. It formed in calcareous alluvium derived dominantly from shale. Areas are elongated and are 20 to 300 acres. The vegetation in areas not cultivated is mainly low shrubs and grass. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is grayish brown silty clay loam about 3 inches thick. The next layer is grayish brown silty clay loam about 9 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray silty clay that has some gypsum crystals. In some areas the surface layer is clay loam or silty clay.

Included in this unit are small areas of Absher loam, Dollard silty clay loam, Havre loam, Patent loam, and Tisworth fine sandy loam. Also included are small areas of soils that are similar to this Kobar soil but are saline. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Kobar soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate.

This unit is used mainly as irrigated and nonirrigated cropland and for livestock grazing. It is also used for urban development and wildlife habitat.

If this unit is used for hay and pasture, the main limitations are slow permeability, slope, and rapid runoff. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Irrigation water can be applied by the sprinkler or controlled flooding methods. Leveling helps to insure the uniform application of water.

Grazing when the soil in this unit is moist results in compaction of the surface layer, poor tilth, and excessive runoff. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Annual applications of nitrogen and phosphorus fertilizer are needed to maintain production of high quality irrigated pasture.

If this unit is used for irrigated crops, the main limitations are slow permeability and the hazard of erosion. In summer, irrigation is needed for maximum production of most crops. Corrugation, furrow, and sprinkler irrigation systems are suited to this unit. The system used generally is governed by the crop grown. Water needs to be applied at a slow rate over a long period to insure that the root zone is properly wetted. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist. Crops respond to nitrogen and phosphorus fertilizer.

If this unit is used for nonirrigated crops, the main limitations are slow permeability and low precipitation. Wheat is the main nonirrigated crop. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Crop residue left on or near the surface helps to conserve moisture, maintain tilth, and control erosion. Crusting of the surface and compaction of the soil can be reduced by returning crop residue to the soil and by using minimum tillage.

Compaction and excessive cloddiness occur if the soil in this unit is cultivated when it is too moist. Practices that can be used to control erosion include early fall seeding, stubble-mulch tillage, and construction of terraces, diversions, and grassed waterways. All tillage should be on the contour or across the slope. On long slopes, chiseling the stubble in fall slows runoff and reduces soil loss in years when the snow melts rapidly while the soil is still frozen. Chiseling also promotes better aeration. Crops respond to small applications of nitrogen fertilizer.

The potential plant community on this unit is mainly western wheatgrass, Letterman needlegrass, muttongrass, slender wheatgrass, and big sagebrush. Smaller amounts of serviceberry, rabbitbrush, and greasewood commonly are also present in the potential plant community. The production of forage is limited by slow permeability, strong alkalinity, and rapid runoff. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in this unit has drained sufficiently and is firm enough to withstand trampling by livestock. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

Range seeding is also suitable if the range is in poor condition. The main limitations for seeding are slow permeability and low precipitation. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist.

This unit is poorly suited to urban development. The main limitations are the potential for shrinking and swelling and slow permeability.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in Deep Clay Loam range site.

49—Kobar silty clay loam, 8 to 15 percent slopes. This deep, well drained soil is on fans and valley side slopes. It formed in calcareous alluvium derived dominantly from shale. Areas are irregular in shape and are 20 to 200 acres in size. The vegetation in areas not cultivated is mainly low shrubs and grasses. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the upper part of the surface layer is grayish brown silty clay loam about 2 inches thick. The lower part is grayish brown silty clay loam about 5 inches thick. The upper 41 inches of the underlying material is light brownish gray, stratified silty clay loam that has some gypsum crystals, and the lower part to a depth of 60 inches or more is light brownish gray silty clay. In some areas the surface layer is clay loam or silty clay.

Included in this unit are small areas of Dollard silty clay loam and Patent loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Kobar soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate to high.

Most areas of this unit are used for livestock grazing and some nonirrigated crops. A few areas are used for urban development and wildlife habitat.

The potential plant community on this unit is mainly western wheatgrass, Letterman needlegrass, muttongrass, slender wheatgrass, and big sagebrush.

Smaller amounts of serviceberry, rabbitbrush, and greasewood commonly are also present in the potential plant community. The production of forage is limited by low precipitation and slow permeability. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in this unit has drained sufficiently and is firm enough to withstand trampling by livestock. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

Range seeding is also suitable if the range is in poor condition. The main limitations for seeding are slow permeability, low precipitation, slope, and the hazard of erosion. For successful seeding, prepare a seedbed and drill in the seed. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

Areas of nonirrigated cropland are highly susceptible to water erosion and soil blowing and generally should be reseeded to grass.

This unit is poorly suited to urban development. The main limitations are the potential for shrinking and swelling, slow permeability, slope, and the hazard of erosion.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in Deep Clay Loam range site.

50—Lamphier-Tampico-Kamack loams, 5 to 60 percent slopes. This map unit is on mountainsides, valley sides, and uplands. Areas are irregular in shape and are 20 to 850 acres in size. The native vegetation is mainly aspen, shrubs, and grasses on the Lamphier and Kamack soils and is mainly sparse stands of aspen, brush, and grasses on the Tampico soil. Elevation is 7,200 to 9,800 feet. The average annual precipitation is 20 to 25 inches, the average annual air temperature is 36 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 35 percent Lamphier loam that has slopes of 5 to 35 percent, 25 percent Tampico loam that has slopes of 15 to 50 percent, and 25 percent Kamack loam that has slopes of 15 to 60 percent. The Lamphier soil is mainly in the more gently sloping areas, the Tampico soil is mainly on uplands and side slopes, and the Kamack soil is mainly on the steeper mountainsides and valley sides. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cochetopa, Cowdrey, Rhone, Silas, and Winnemucca loams and Miracle fine sandy loam. Also included are small areas of soils that are similar to the Lamphier, Tampico, and Kamack soils but are shallow and moderately deep to sandstone and small areas of Rock outcrop in the steeper areas. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Lamphier soil is deep and well drained. It formed in alluvium and colluvium derived dominantly from red-bed sandstone. Typically, the surface is covered with a mat of decomposing leaves and twigs 2 inches thick. The surface layer is brown loam 26 inches thick. The underlying material to a depth of 60 inches or more is reddish brown loam.

Permeability of the Lamphier soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high.

The Tampico soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from red-bed sandstone and shale. Typically, the surface is covered with a mat of partially decomposed leaves and twigs 2 inches thick. The upper part of the surface layer is dark reddish gray loam about 11 inches thick, and the lower part is reddish gray loam about 4 inches thick. The upper 15 inches of the subsoil is reddish brown loam, and the lower 12 inches is reddish brown clay loam. The substratum to a depth of 60 inches or more is reddish brown cobbly clay loam. The rock fragments are angular. In some areas the surface layer is fine sandy loam.

Permeability of the Tampico soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high to very high.

The Kamack soil is deep and well drained. It formed in residuum and colluvium derived dominantly from red-bed sandstone. Typically, the surface is covered with a mat of partially decomposed leaves 1/2 inch thick. The surface layer is reddish brown loam 14 inches thick. The upper 8 inches of the subsoil is light reddish brown very gravelly loam, and the lower 10 inches is light reddish brown very cobbly loam. The substratum to a depth of 55 inches is reddish brown very cobbly light loam. The rock fragments are angular. Hard sandstone is at a depth of 55 inches. Depth to fractured and weathered bedrock ranges from 40 to 60 inches.

Permeability of the Kamack soil is moderate. Available water capacity is moderate to low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is very high.

Most areas of this unit are used for livestock grazing in summer and for wildlife habitat. A few areas are used as woodland.

The potential plant community on the Lamphier soil is mainly aspen with an understory of nodding brome, Colorado blue wildrye, bluegrasses, slender wheatgrass, and mountain brome. The average annual production of air-dry vegetation is about 2,500 pounds per acre.

The potential plant community on the Tampico soil is mainly Saskatoon serviceberry, snowberry, mountain brome, Columbia needlegrass, and elk sedge. Smaller amounts of slender wheatgrass, bluegrasses, and Gambel oak commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

The potential plant community on the Kamack soil is mainly open stands of aspen with an understory of mountain brome, nodding brome, Colorado blue wildrye, and bluegrass. Smaller amounts of Saskatoon serviceberry, Columbia needlegrass, and snowberry commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

The production of forage is limited by a short growing season. The major management practices suitable for use on this unit are thinning of aspen stands, deferred grazing, and rotation grazing. Slope limits access by livestock and results in overgrazing of the less sloping areas.

The Lamphier soil is well suited to the production of aspen for use as saw logs and firewood. The main concerns in producing and harvesting timber are year-round access, steepness of slope, and erodibility of disturbed areas.

This unit provides excellent cover and forage for elk, mule deer, and grouse, mainly from late in spring to late in fall.

This map unit is in capability subclass VIIe, nonirrigated. The Lamphier and Kamack soils are in Aspen woodland site, and the Tampico soil is in Brushy Loam range site.

51—Mergel-Redthayne-Dollard complex, 8 to 65 percent slopes. This map unit is on mountainsides, hills, toe slopes, and ridges. Areas are elongated in shape and are 20 to 750 acres in size. The native vegetation is mainly shrubs and grasses. Elevation is 6,500 to 7,400 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 43 degrees F, and the average frost-free period is 80 to 105 days.

This unit is 35 percent Mergel channery loam that has slopes of 8 to 65 percent, 30 percent Redthayne channery loam that has slopes of 8 to 65 percent, and 20 percent Dollard silty clay loam that has slopes of 15 to 40 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Blazon and Rentsac channery loams, Zoltay clay loam, and Rock outcrop. Also included are soils that are similar to the Mergel, Redthayne, and Dollard soils but are moderately deep or shallow. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Mergel soil is deep and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the upper part of the surface layer is grayish brown channery loam about 9 inches thick. The lower part is light brownish gray channery loam about 3 inches thick. The upper 10 inches of the underlying material is pale brown very channery clay loam, the next 28 inches is light brownish gray very channery loam, and the lower part to a depth of 60 inches or more is brown very channery loam. In some areas the surface layer is channery fine sandy loam.

Permeability of the Mergel soil is moderate. Available water capacity is low because of the content of rock fragments. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high to very high.

The Redthayne soil is deep and well drained. It formed in colluvium derived dominantly from sandstone. Typically, the surface layer is brown channery loam 8 inches thick. The subsoil is light brown very channery loam 10 inches thick. The substratum to a depth of 60 inches or more is light brown very channery loam. In some areas the surface layer is channery sandy loam.

Permeability of the Redthayne soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high to very high.

The Dollard soil is moderately deep and well drained. It formed in residuum and colluvium derived from shale. Typically, the surface layer is very pale brown silty clay loam 3 inches thick. The next layer is light yellowish brown silty clay loam 8 inches thick. Below this is yellow to gray silty clay loam 15 inches thick. Clayey shale is at a depth of 26 inches. Depth to shale ranges from 20 to 40 inches. The soil is calcareous throughout. In some areas the surface is covered with channery fragments or cobbles.

Permeability of the Dollard soil is slow. Available water capacity is medium. Effective rooting depth is 20 to 40 inches. Runoff is medium to very rapid, and the hazard of water erosion is moderate to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Mergel and Redthayne soils is mainly serviceberry, big sagebrush, bluebunch wheatgrass, prairie junegrass, mountainmahogany, and Indian ricegrass. Smaller amounts of western wheatgrass, snowberry, low rabbitbrush, elk sedge, and some Gambel oak commonly are also present in the potential plant community. The potential plant community on the Dollard soil is mainly western wheatgrass, prairie junegrass, Indian ricegrass, big sagebrush, low rabbitbrush, and milkvetch. The

average annual production of air-dry vegetation is about 1,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on the soil in this unit are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of the difficulty of brush removal and steepness of slope.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This map unit is in capability subclass VIIe, nonirrigated. The Mergel and Redthayne soils are in Loamy Slopes range site, and the Dollard soil is in Clayey Foothills range site.

52—Miracle fine sandy loam, 3 to 25 percent slopes. This moderately deep, well drained soil is on mountainsides and upland hills and ridges. It formed in colluvium and residuum derived dominantly from red-bed sandstone and shale. Areas are irregular in shape and are 40 to 750 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 7,300 to 8,600 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the upper part of the surface layer is dark reddish gray fine sandy loam 8 inches thick. The lower part is reddish brown loam 7 inches thick. The upper 7 inches of the subsoil is reddish brown loam, and the lower 5 inches is reddish brown sandy clay loam. Below this is weathered sandstone 5 inches thick. Hard sandstone is at a depth of 32 inches. Depth to hard sandstone ranges from 20 to 40 inches. The soil is 0 to 15 percent small angular rock fragments throughout.

Included in this unit are small areas of Kamack and Tampico loams, soils that have a cobbly, stony, or flaggy surface layer, and soils that are similar to this Miracle soil but are shallow to rock. Also included are small areas of Rock outcrop. Rock outcrop consists of scattered tilted edges and small bluffs of red-bed sandstone or limestone ledges. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Miracle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is slight to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly big sagebrush, Idaho fescue, Letterman needlegrass, and mountain brome. Smaller amounts of low rabbitbrush, snowberry, and Gambel oak commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are also suitable practices where slopes are less than 15 percent. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. For successful seeding, prepare a seedbed and drill in the seed.

This unit is used extensively as range for elk and mule deer in summer and fall.

This map unit is in capability subclass VIe, nonirrigated. It is in Mountain Loam range site.

53—Moyerson stony clay loam, 15 to 65 percent slopes. This shallow, well drained soil is on ridges and side slopes of dissected plateaus. It formed in residuum derived from calcareous shale. Areas are elongated and are 30 to 1,000 acres. The native vegetation is mainly grasses and low shrubs. Elevation is 5,600 to 7,300 feet. The average annual precipitation is 13 to 16 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, 5 to 20 percent of the surface is covered with stones, flagstones, and boulders. The surface layer is light gray stony clay loam 2 inches thick. The next layer is light gray clay loam 8 inches thick. The underlying material is light gray clay about 7 inches thick. Fractured shale is at a depth of 17 inches. Depth to shale ranges from 10 to 20 inches. The soil is calcareous throughout.

Included in this unit are small areas of Abor clay loam, Blazon channery loam, Dollard silty clay loam, and Rentsac channery loam. Also included are small areas of Rock outcrop and areas of soils that do not have rock fragments on the surface. Rock outcrop consists of horizontal ledges that generally are 5 to 200 feet wide and 5 to 15 feet thick. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Moyerson soil is slow. Available water capacity is low. Effective rooting depth is 10 to 20

inches. Runoff is rapid, and the hazard of water erosion is very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Salina wildrye, Indian ricegrass, Sandberg bluegrass, and shadscale. Smaller amounts of bottlebrush squirreltail, galleta, spiny horsebrush, and western wheatgrass commonly are also present in the potential plant community. The production of forage is limited by low precipitation and droughtiness because of the shallow depth of the soil. The average annual production of air-dry vegetation is about 650 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This unit provides forage in winter for mule deer.

This map unit is in capability subclass VIIe, nonirrigated. It is in Clayey Slopes range site.

54—Nagitsy-Irigul channery loams, 5 to 50 percent slopes. This map unit is on mountainsides, ridges, and hills. Areas are irregular in shape and are 60 to 1,000 acres in size. The native vegetation is mainly shrubs and grasses. Elevation is 7,500 to 8,500 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 50 percent Nagitsy channery loam that has slopes of 5 to 50 percent and 35 percent Irigul channery loam that has slopes of 15 to 50 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Absarokee channery loam, Clayburn loam, and Winnemucca loam. Also included are small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Nagitsy soil is moderately deep and well drained. It formed in residuum and colluvium derived from sandstone and shale. Typically, the upper part of the surface layer is very dark grayish brown channery loam about 7 inches thick. The lower part is dark grayish brown channery loam about 16 inches thick. The subsoil is brown very channery loam 10 inches thick. Hard sandstone is at a depth of 33 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability of the Nagitsy soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is slight to high.

The Irigul soil is shallow and well drained. It formed in residuum derived dominantly from sandstone and hard shale. Typically, the surface layer is grayish brown channery loam 5 inches thick. The underlying material is brown extremely channery loam 7 inches thick. Hard sandstone is at a depth of 12 inches. Depth to sandstone ranges from 10 to 20 inches.

Permeability of the Irigul soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Nagitsy soil is mainly Gambel oak, serviceberry, mountain brome, elk sedge, snowberry, and beardless wheatgrass. The potential plant community on the Irigul soil is mainly western wheatgrass, beardless wheatgrass, prairie junegrass, serviceberry, big sagebrush, and bitterbrush. Smaller amounts of bluegrass, low rabbitbrush, chokecherry, slender wheatgrass, Columbia needlegrass, and rose commonly are also present in the potential plant community. The production of vegetation suitable for livestock grazing is limited by the short growing season and low available water capacity. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are also suitable practices where slopes are less than 15 percent. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

The main limitations for seeding are the short growing season and depth to rock. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

This unit is used extensively as winter range for mule deer and elk.

This map unit is in capability subclass VIIe, nonirrigated. The Nagitsy soil is in Brushy Loam range site, and the Irigul soil is in Loamy Slopes range site.

55—Nihill channery sandy loam, 5 to 50 percent slopes. This deep, somewhat excessively drained soil is on toe slopes and terrace edges. It formed in colluvium derived dominantly from sandstone. Areas are elongated and are 20 to 300 acres. The native vegetation is mainly desert shrubs and grasses. Scattered pinyon and juniper trees are in some areas. Elevation is 5,100 to 5,800 feet. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 47 to 49 degrees F, and the average frost-free period is 105 to 130 days.

Typically, 40 to 45 percent of the surface is covered with rock fragments, of which 5 to 10 percent is flagstones and 35 percent is channery fragments. The surface layer is brown channery sandy loam 5 inches thick. The upper 18 inches of the underlying material is pale brown channery loam and very channery loam, and the lower part to a depth of 60 inches or more is pale brown very channery sandy loam.

Included in this unit are small areas of Cliffdown gravelly loam, Clifterson channery loam, and Kinnear and Turley fine sandy loams. Also included are small areas of soils that are similar to this Nihill soil but have a loam or very stony loam surface layer. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Nihill soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to very high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used as a source of roadfill.

The potential plant community on this unit is mainly galleta, Indian ricegrass, shadscale, and big sagebrush. Smaller amounts of Salina wildrye, bottlebrush squirreltail, and Douglas rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by low precipitation and droughtiness. The average annual production of air-dry vegetation is about 350 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Brush management and seeding are also suitable practices where slopes are less than 15 percent. The main limitations for seeding are slope, the channery rock fragments and flagstones on the surface, and low precipitation. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

Areas of this unit where slopes are less than 25 percent are suitable as a source of roadfill.

This map unit is in capability subclass VIIe, nonirrigated. It is in Saltdesert Breaks range site.

56—Northwater loam, 5 to 50 percent slopes. This deep, well drained soil is on mountainsides. It formed in residuum and colluvium derived from sedimentary rock. Areas are long and narrow or irregular in shape and are 40 to 400 acres in size. The native vegetation is mainly aspen, brush, and grasses. Elevation is 7,700 to 8,400 feet. The average annual precipitation is 19 to 21 inches, the average annual air temperature is 36 to 40 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the surface is covered with a mat of partially decomposed leaves 2 inches thick. The upper part of the surface layer is grayish brown loam about 4 inches thick, and the lower part is grayish brown loam about 16 inches thick. The upper part of the subsoil is brown loam 5 inches thick, and the lower part is pale brown very channery sandy clay loam 16 inches thick. The substratum is light yellowish brown very channery loam 6 inches thick. Fractured sandstone is at a depth of 47 inches. Depth to sandstone ranges from 40 to 60 inches.

Included in this unit are small areas of Parachute loam, Starman channery loam, Rhone loam, and Vandamore channery loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Northwater soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly aspen with an understory of mountain brome, slender wheatgrass, snowberry, and serviceberry. Smaller amounts of elk sedge, Colorado blue wildrye, aspen peavine, and chokecherry commonly are also present in the potential plant community. The production of forage is limited by a short growing season and plant competition from the overstory of aspen. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Slope limits access by livestock and results in overgrazing of the less sloping areas.

This map unit is in capability subclass VIIe, nonirrigated. It is in Aspen woodland site.

57—Owen Creek-Jerry-Burnette loams, 5 to 35 percent slopes. This map unit is on hillcrests, ridges, and mountainsides. Areas are elongated and are 50 to 1,000 acres. The native vegetation is mainly mountain brush with open areas of low shrubs and grasses. Elevation is 7,200 to 8,600 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 36 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 40 percent Owen Creek loam that has slopes of 5 to 20 percent, 30 percent Jerry loam that has slopes of 5 to 35 percent, and 20 percent Burnette loam that has slopes of 5 to 20 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Lamphier loam, Rhone loam, Vandamore Variant channery loam, and Waybe flaggy clay loam. Also included are small areas of Rock outcrop and soils that are similar to the Owen Creek, Jerry, and Burnette soils but have steeper slopes. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Owen Creek soil is moderately deep and well drained. It formed in residuum derived dominantly from shale that has thin lenses of interbedded sandstone. Typically, the surface layer is grayish brown loam 5 inches thick. The upper 4 inches of the subsoil is grayish brown clay loam, and the lower 14 inches is grayish brown clay. The substratum is gray clay 1 inch thick. Weathered shale is at a depth of 24 inches. Depth to shale and interbedded sandstone ranges from 20 to 40 inches.

Permeability of the Owen Creek soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate to high.

The Jerry soil is deep and well drained. It formed in residuum derived dominantly from shale. Typically, the upper part of the surface layer is dark grayish brown loam about 2 inches thick. The lower part is brown loam about 3 inches thick. The next layer is brown loam 8 inches thick. The upper 21 inches of the subsoil is yellowish brown channery clay loam, and the lower 14 inches is light olive brown channery clay loam. The substratum to a depth of 60 inches or more is light yellowish brown channery clay loam.

Permeability of the Jerry soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high.

The Burnette soil is deep and well drained. It formed in colluvium and residuum derived dominantly from shale. Typically, the upper part of the surface layer is grayish brown loam about 5 inches thick. The lower part is grayish brown clay loam about 5 inches thick. The upper 20 inches of the subsoil is brown clay, and the lower 8 inches is yellowish brown clay. The next layer is light brownish gray clay 8 inches thick. The substratum to a depth of 60 inches or more is light brownish gray clay. Highly calcareous, soft shale that has thin lenses of sandstone is at a depth of 5 to 8 feet.

Permeability of the Burnette soil is slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high.

Most areas of this unit are used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly serviceberry, Letterman needlegrass, mountain brome, bluegrasses, snowberry, and big sagebrush. Smaller amounts of slender wheatgrass, western wheatgrass, elk sedge, chokecherry, and some Gambel oak commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Brush management and seeding are also suitable practices where slopes are less than 15 percent.

The main limitations for seeding are slow permeability, difficulty of brush removal, and the short growing season. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum. These soils are subject to landsliding and slumping.

This map unit is in capability subclass VIIe, nonirrigated. It is in Brushy Loam range site.

58—Parachute loam, 25 to 75 percent slopes. This moderately deep, well drained soil is on ridges and mountainsides. It formed in residuum derived dominantly from sandstone. Slopes generally face north. Areas are elongated and are 20 to 600 acres. The native vegetation is mainly brush and grasses. Elevation is 7,500 to 8,700 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the surface layer is grayish brown loam 4 inches thick. The upper 10 inches of the subsoil is loam, and the lower 10 inches is channery loam. The next layer is very channery loam 8 inches thick. The substratum is extremely channery sandy loam 6 inches thick. Fractured sandstone is at a depth of 38 inches. Depth to sandstone ranges from 20 to 40 inches.

Included in this unit are small areas of Irigul channery loam, Starman channery loam, Rhone loam, and Vandamore channery loam. Also included are small areas of soils that are similar to this Parachute soil but are less than 35 percent rock fragments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Parachute soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Letterman needlegrass, elk sedge, serviceberry, Columbia needlegrass, big sagebrush, and Idaho fescue. Smaller amounts of Gambel oak, mountain brome, rose, and snowberry commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

This unit is used extensively by mule deer and grouse from late in spring to late in fall.

This map unit is in capability subclass VIIe, nonirrigated. It is in Brushy Loam range site.

59—Parachute-Rhone loams, 5 to 30 percent slopes. This map unit is on mountainsides and upland ridges. Areas are irregular in shape and are 40 to 600 acres in size. The native vegetation is mainly brush and grasses. Elevation is 7,600 to 8,600 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 55 percent Parachute loam and 35 percent Rhone loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Castner channery loam, Irigul channery loam, Northwater loam, Starman and Vandamore soils, and Veatch channery loam. Also included are small areas of Rock outcrop and soils that are similar to these Parachute and Rhone soils but are more steeply sloping. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Parachute soil is moderately deep and well drained. It formed in residuum derived dominantly from sandstone. Typically, the surface layer is grayish brown loam 4 inches thick. The upper 10 inches of the subsoil is grayish brown loam, and the lower 10 inches is grayish brown channery loam. The next layer is pale brown very channery loam 8 inches thick. The substratum is very pale brown extremely channery sandy loam 6 inches thick. Fractured sandstone is at a depth of about 38 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability of the Parachute soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate to high.

The Rhone soil is deep and well drained. It formed in residuum and colluvium derived dominantly from sandstone. Typically, the upper part of the surface layer is dark grayish brown loam about 8 inches thick, the next 16 inches is dark grayish brown loam, and the lower part is grayish brown very channery loam 16 inches thick. The substratum is brown very channery loam 10 inches thick. Fractured sandstone is at a depth of about 50 inches. Depth to sandstone ranges from 40 to 60 inches.

Permeability of the Rhone soil is moderate. Available water capacity is high. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate to high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Letterman needlegrass, Columbia needlegrass, Idaho fescue, big sagebrush, serviceberry, and snowberry. Smaller amounts of Gambel oak, mountain brome, and elk sedge commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Grazing should be delayed until the soil in the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

Brush management and seeding are also suitable practices where slopes are less than 15 percent. The main limitations for seeding are difficulty of brush removal and a short growing season. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass VIe, nonirrigated. It is in Mountain Loam range site.

60—Patent loam, 0 to 3 percent slopes. This deep, well drained soil is on fans and terraces. It formed in alluvium and colluvium derived dominantly from sandstone. Areas are irregular in shape and are 20 to 160 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 6,800 feet. The average annual precipitation is 14 to 17 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is brown loam 3 inches thick. The next layer is brown loam 7 inches thick. The upper 14 inches of the underlying material is very pale brown loam, and the lower part to a depth of 60 inches or more is very pale brown very fine sandy loam. The soil is calcareous throughout, and it contains varying amounts of gypsum.

Included in this unit are small areas of Forelle loam, Havre loam, Kobar silty clay loam, and Zoltay clay loam. Also included are small areas of soils that are similar to this Patent soil but are more than 15 percent rock fragments and small areas of soils that have a sandy loam surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Patent soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

This unit is used mainly as irrigated and nonirrigated cropland and for livestock grazing. It is also used for urban development and wildlife habitat. Hay and pasture are the main irrigated crops, and wheat is the main nonirrigated crop.

This unit is well suited to hay and pasture. Furrow, border, corrugation, and sprinkler irrigation systems can be used. Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This unit is well suited to nonirrigated small grain. It is limited mainly by low precipitation in summer. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content.

The potential plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, needleandthread, big sagebrush, Sandberg bluegrass, and Douglas rabbitbrush. The production of forage is limited by low precipitation in summer. The average annual production of air-dry vegetation is about 800 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for urban development, the main limitation is the potential for shrinking and swelling. If buildings are constructed on the unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. Structures to divert runoff are also needed if roads are constructed. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass IIIc. It is in Rolling Loam range site.

61—Patent loam, 3 to 8 percent slopes. This deep, well drained soil is on fans and toe slopes. It formed in alluvium, colluvium, and a thin mantle of eolian material. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 6,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is brown loam 3 inches thick. The next layer is brown loam 7 inches thick. The upper 14 inches of the underlying material is very pale brown loam, and the lower part to a depth of 60 inches or more is very pale brown very fine sandy loam. The soil is calcareous throughout, and it contains varying amounts of gypsum.

Included in this unit are small areas of Forelle loam, Havre loam, Kobar silty clay loam, and Zoltay loam. Also included are small areas of soils that are similar to this Patent soil but are more than 15 percent rock fragments and that have a sandy loam surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Patent soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly as irrigated and nonirrigated cropland and for livestock grazing. It is also used for urban development and wildlife habitat. Hay and pasture are the main irrigated crops, and wheat is the main nonirrigated crop.

This unit is well suited to hay and pasture. The main limitations are an inadequate supply of irrigation water and slope. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for nonirrigated small grain crops, the main limitations are slope and low precipitation in summer. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content.

The potential plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, needleandthread, big sagebrush, Sandberg bluegrass, and Douglas rabbitbrush. The average annual production of air-dry vegetation is about 800 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for urban development, the main limitation is the potential for shrinking and swelling. If buildings are constructed on the unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. Structures to divert runoff are also needed if roads are constructed. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass IIIe. It is in Rolling Loam range site.

62—Patent loam, 8 to 15 percent slopes. This deep, well drained soil is on fans and toe slopes. It formed in alluvium, colluvium, and a thin mantle of eolian material. Areas are irregular in shape and are 20 to 150 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 6,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is brown loam 3 inches thick. The next layer is brown loam 7 inches thick. The upper 14 inches of the underlying material is very pale brown loam, and the lower part to a depth of 60 inches or more is very pale brown very fine sandy loam. The soil is calcareous throughout, and it contains varying amounts of gypsum.

Included in this unit are small areas of Dollard silty clay loam, Forelle loam, Kobar silty clay loam, and Zoltay clay loam. Also included are small areas of soils that are similar to this Patent soil but are more than 15 percent rock fragments and soils that have a sandy loam surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Patent soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high.

This unit is used mainly for livestock grazing, nonirrigated cropland, and wildlife habitat. It is also used for urban development.

The potential plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, needleandthread, big sagebrush, Sandberg bluegrass, Douglas rabbitbrush, and serviceberry. The average annual production of air-dry vegetation is about 750 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Brush management and seeding are also suitable practices where slopes are less than 15 percent. The main limitations for seeding are slope and low precipitation in summer. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for nonirrigated small grain crops, the main limitations are slope and low precipitation in summer. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Crusting of the surface and compaction of the soil can be reduced by returning crop residue to the soil and by using minimum tillage.

If this unit is used for urban development, the main limitations are slope and the potential for shrinking and swelling. If buildings are constructed on the unit, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling. Structures to divert runoff are also needed if roads are constructed. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass IVe. It is in Rolling Loam range site.

63—Patent loam, 15 to 25 percent slopes. This deep, well drained soil is on toe slopes. It formed in alluvium, colluvium, and a thin mantle of eolian material. Areas are irregular in shape and are 20 to 160 acres in size. The native vegetation is mainly low shrubs, grasses, and a few pinyon and juniper trees. Elevation is 5,800 to 6,800 feet. The average annual precipitation is 15 to 17 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is brown loam 5 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, stratified loam and very fine sandy loam and is as much as 15 percent rock fragments. The soil is calcareous throughout, and it contains varying amounts of gypsum.

Included in this unit are small areas of Dollard silty clay loam, Forelle loam, Kobar silty clay loam, and Zoltay clay loam. Also included are small areas of soils that are similar to this Patent soil but have a sandy loam or cobbly loam surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Patent soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, needleandthread, big sagebrush, Sandberg bluegrass, Douglas rabbitbrush, and serviceberry. The average annual production of air-dry vegetation is about 650 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The suitability of this unit for rangeland seeding is very poor. The main limitations are steepness of slope and low precipitation in summer.

This map unit is in capability subclass VIe, nonirrigated. It is in Rolling Loam range site.

64—Piceance fine sandy loam, 5 to 15 percent slopes. This moderately deep, well drained soil is on uplands and broad ridgetops. It formed in eolian material and colluvium derived dominantly from sandstone. Areas are elongated and are 20 to 600 acres. The native vegetation is mainly low shrubs, grasses, and a few pinyon trees. Elevation is 6,300 to 7,500 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is brown fine sandy loam 4 inches thick. The upper 5 inches of the subsoil is brown loam, and the lower 13 inches is light yellowish brown loam. The substratum is very pale brown channery loam 8 inches thick. Hard sandstone is at a depth of 30 inches. Depth to sandstone ranges from 20 to 40 inches.

Included in this unit are small areas of Forelle loam, Redcreek sandy loam, Rentsac channery loam, and Yamac loam. Also included are small areas of Rock outcrop and soils that are similar to this Piceance soil but are shallow to bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Piceance soil is moderate. Available water capacity is moderately low. Effective

rooting depth is 20 to 40 inches. Runoff is slow to medium, and the hazard of water erosion is moderate to high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, big sagebrush, serviceberry, prairie junegrass, and sand lupine. Smaller amounts of needleandthread, Indian ricegrass, and bluegrass commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 800 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. The main limitation for seeding is low precipitation in summer. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass VIe, nonirrigated. It is in Rolling Loam range site.

65—Pinelli clay loam, 3 to 12 percent slopes. This deep, well drained soil is on fans and terraces along intermittent drainageways. It formed in mixed alluvium derived dominantly from shale. Areas are irregular to triangular in shape and are 40 to 160 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 6,500 to 7,000 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is light brownish gray clay loam 3 inches thick. The upper 10 inches of the subsoil is light brownish gray silty clay loam, and the lower 13 inches is light brownish gray, strongly calcareous silty clay loam. The next layer is pale brown silty clay loam 5 inches thick. The substratum to a depth of 60 inches or more is pale brown silty clay loam.

Included in this unit are small areas of Buckley channery silty clay loam, Dollard silty clay loam, Havre loam, Kobar silty clay loam, and Shawa loam, wet. Also included are small areas of soils that are similar to this Pinelli soil but are moderately deep. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Pinelli soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate to high.

Most areas of this unit are used as irrigated and nonirrigated cropland. Hay and pasture are the main irrigated crops. A few areas are used for livestock grazing and wildlife habitat.

Areas of nonirrigated cropland are highly susceptible to water erosion and soil blowing and generally should be reseeded to grass.

If this unit is used for hay and pasture, the main limitations are moderately slow permeability and the hazard of erosion. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Irrigation water can be applied by the furrow, corrugation, or sprinkler methods. Leveling helps to insure the uniform application of water. Water needs to be applied at a slow rate over a long period to insure that the root zone is properly wetted.

Grazing when the soil is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus.

The potential plant community on this unit is mainly western wheatgrass, prairie junegrass, Indian ricegrass, big sagebrush, low rabbitbrush, and winterfat. The production of forage is limited by moderately slow permeability and low precipitation in summer. The average annual production of air-dry vegetation is about 900 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this soil are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. The main limitations for seeding are moderately slow permeability and the hazard of erosion. For successful seeding, prepare a seedbed and drill in the seed. Compaction and excessive cloddiness occur if the soil is cultivated when it is too moist. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass IVe. It is in Clayey Foothills range site.

66—Potts-Begay fine sandy loams, 2 to 7 percent slopes. This map unit is on fans and uplands. Areas are irregular in shape and are 20 to 1,000 acres in size. The native vegetation is mainly shrubs and grasses. Elevation is 5,400 to 6,000 feet. The average annual precipitation is 9 to 12 inches, the average annual air temperature is 47 to 49 degrees F, and the average frost-free period is 105 to 130 days.

This unit is 60 percent Potts fine sandy loam and 20 percent Begay fine sandy loam.

Included in this unit are small areas of Chipeta and Killpack silty clay loams, Kinnear fine sandy loam, and Walknolls channery sandy loam. Also included are small areas of Rock outcrop.

The Potts soil is deep and well drained. It formed in eolian and alluvial material derived dominantly from sandstone. Typically, the surface layer is brown fine sandy loam 3 inches thick. The upper 11 inches of the subsoil is brown loam, and the lower 3 inches is light brown loam. The substratum to a depth of 60 inches or more is pink loam. In some areas the surface layer is sandy loam or loam.

Permeability of the Potts soil is moderate. Available water capacity is moderately high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is moderate.

The Begay soil is deep and well drained. It formed in eolian and alluvial material derived dominantly from sandstone. Typically, the upper part of the surface layer is light yellowish brown fine sandy loam about 3 inches thick. The lower part is light brown fine sandy loam about 6 inches thick. The subsoil is light brown fine sandy loam 9 inches thick. The upper 12 inches of the substratum is pink fine sandy loam, and the lower part to a depth of 60 inches or more is pink loamy fine sand. In some areas the surface layer is sandy loam or loam.

Permeability of the Begay soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate if the vegetation is removed.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Potts soil is mainly galleta, Indian ricegrass, thickspike wheatgrass, big sagebrush, and low rabbitbrush. Smaller amounts of bottlebrush squirreltail, shadscale, and winterfat commonly are also present in the potential plant community. The potential plant community on the Begay soil is mainly needleandthread, Indian ricegrass, sand dropseed, big sagebrush, and Douglas rabbitbrush. Smaller amounts of bottlebrush squirreltail, shadscale, and winterfat commonly are also present in the potential plant community. The production of forage is limited by low precipitation. The average annual production of air-dry vegetation on these soils is about 600 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

Range seeding is also suitable if the range is in poor condition. The main limitation is low precipitation. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass VIe, nonirrigated. The Potts soil is in Loamy Saltdesert range site, and the Begay soil is in Sandy Saltdesert range site.

67—Rabbitex flaggy loam, 10 to 65 percent slopes. This deep, well drained soil is on mountainsides. It formed in residuum and colluvium derived dominantly from sandstone. Slopes generally face north. Areas are irregular in shape and are 40 to 500 acres in size. The native vegetation is mainly pinyon and juniper with an understory of brush and grasses. Elevation is 6,400 to 7,900 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 40 to 42 degrees F, and the average frost-free period is 75 to 100 days.

Typically, as much as 2 percent of the surface is covered with stones. The surface layer is brown flaggy loam about 12 inches thick. The next layer is pale brown channery loam about 9 inches thick. The underlying material is channery loam 22 inches thick. Sandstone is at a depth of 43 inches. Depth to sandstone ranges from 40 to 60 inches. The soil is calcareous throughout. In some areas the surface layer is channery fine sandy loam or channery sandy loam.

Included in this unit are small areas of Moyerson stony clay loam, Rentsac channery loam, and Work loam. Also included are small areas of soils that are similar to this Rabbitex soil but are less than 40 inches deep to bedrock or are more than 35 percent rock fragments. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Rabbitex soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate to very high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used as woodland.

The potential plant community on this unit is mainly pinyon and Utah juniper trees with an understory of serviceberry, mountainmahogany, muttongrass, and beardless wheatgrass. Smaller amounts of needleandthread, snowberry, and big sagebrush commonly are also present in the potential plant

community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 750 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Mule deer use this unit for food and cover year-round.

This unit is well suited to the production of pinyon and juniper trees for use as firewood, fenceposts, and Christmas trees.

This map unit is in capability subclass VIIe, nonirrigated. It is in Pinyon-Juniper woodland site.

68—Rabbitex-Work loams, 10 to 25 percent slopes. This map unit is on mountainsides and high uplands. Areas are irregular in shape and are 20 to 400 acres in size. The native vegetation is mainly pinyon and juniper trees on the Rabbitex soil and low shrubs and grasses on the Work soil. Elevation is 7,300 to 8,000 feet. The average annual precipitation is 17 to 20 inches, the average annual air temperature is 38 to 40 degrees F, and the average frost-free period is 75 to 95 days.

This unit is 50 percent Rabbitex loam and 30 percent Work loam. Slopes of the Work soil generally are smoother than those of the Rabbitex soil and are slightly concave.

Included in this unit are small areas of Blazon channery loam, Moyerson stony clay loam, Parachute loam, Razorba channery sandy loam, and Rentsac very channery loam. Also included are small areas of Rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Rabbitex soil is deep and well drained. It formed in residuum and colluvium derived dominantly from sandstone. Typically, the upper part of the surface layer is brown flaggy loam about 12 inches thick. The next layer is pale brown channery loam about 9 inches thick. The underlying material is white channery loam 22 inches thick. Highly weathered and fractured sandstone is at a depth of 43 inches. Depth to sandstone ranges from 40 to 60 inches. The soil is calcareous throughout.

Permeability of the Rabbitex soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is moderate to high.

The Work soil is deep and well drained. It formed in eolian and alluvial material derived from mixed sedimentary rock. Typically, the surface layer is brown loam 10 inches thick. The upper 5 inches of the subsoil is brown clay loam, and the lower 10 inches is light brown clay loam. The next layer is light brown clay loam 5 inches thick. The upper 20 inches of the substratum is pink clay loam, and the lower part to a depth of 60 inches or more is pink loam.

Permeability of the Work soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to very high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used as woodland.

The potential plant community on this unit is mainly pinyon pine and Utah juniper trees with an understory of serviceberry, mountainmahogany, muttongrass, and beardless wheatgrass. Smaller amounts of needleandthread, snowberry, and big sagebrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 900 pounds per acre.

Most wildlife in the area use this unit year-round for food and cover.

The Rabbitex soil is well suited to the production of pinyon and juniper trees for use as firewood, fenceposts, and Christmas trees.

This map unit is in capability subclass VIe, nonirrigated. The Rabbitex soil is in Pinyon-Juniper woodland site. The Work soil is in Deep Loam range site.

69—Razorba channery sandy loam, 30 to 75 percent slopes. This deep, well drained soil is on mountainsides. It formed in residuum and colluvium derived dominantly from sandstone. Slopes mainly face north. Areas are long and narrow and are 40 to 600 acres. The native vegetation is mainly sparse stands of spruce and fir trees. Elevation is 7,500 to 8,400 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the surface is covered with a mat of partially decomposed needles, leaves, and twigs 1 inch thick. The upper part of the surface layer is dark grayish brown, calcareous channery sandy loam about 9 inches thick, and the lower part is dark grayish brown, strongly calcareous channery sandy loam about 26 inches thick. The underlying material to a depth of 60 inches or more is grayish brown, strongly calcareous channery sandy loam.

Included in this unit are small areas of Irigul channery loam, Parachute loam, and Rhone loam. Also included are small areas of soils that are similar to this Razorba soil but are 20 to 40 inches deep to sandstone, soils that have a more clayey subsoil, and soils that are more than 35 percent rock fragments. Also included are short, narrow bluffs of interbedded sandstone or hard shale outcroppings 3 to 15 feet thick and 10 to 100 feet long. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Razorba soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is very high.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for very limited production of firewood and poles.

The potential plant community on this unit is mainly thin stands of spruce and fir trees with an understory of serviceberry, snowberry, mountain brome, and slender wheatgrass. Smaller amounts of Gambel oak, small aspen, and some pinyon in the lower lying areas commonly are also present in the potential plant community. The production of vegetation suitable for livestock grazing is limited by a short growing season. The potential production of the native understory vegetation in normal years is about 350 pounds of air-dry vegetation per acre.

This unit is poorly suited to marketable woodland trees; however, some firewood and corral poles are harvested in some parts of the unit. The main concerns in producing and harvesting timber are steepness of slope and the small size of the areas of the unit.

This map unit is in capability subclass VIIe, nonirrigated. It is in Spruce-Fir woodland site.

70—Redcreek-Rentsac complex, 5 to 30 percent slopes. This map unit is on mountainsides and ridges. Areas are elongated and are 40 to 300 acres. The native vegetation is mainly pinyon and juniper trees with an understory of shrubs and grasses. Elevation is 6,000 to 7,400 feet. The average annual precipitation is 14 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

This unit is 60 percent Redcreek sandy loam and 30 percent Rentsac channery loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Forelle loam, Piceance fine sandy loam, and Yamac loam. Also included are small areas of Rock outcrop and soils that are similar to these Redcreek and Rentsac soils but are 20 to 40 inches deep to bedrock. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Redcreek soil is shallow and well drained. It formed in residual and eolian material derived dominantly from sandstone. Typically, the surface layer is brown sandy loam about 4 inches thick. The next layer is brown, calcareous sandy loam about 7 inches thick. The underlying material is very pale brown, calcareous channery loam 5 inches thick. Hard sandstone is at a depth of 16 inches. Depth to hard sandstone or hard shale ranges from 10 to 20 inches.

Permeability of the Redcreek soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate to high.

The Rentsac soil is shallow and well drained. It formed in residuum derived dominantly from sandstone. Typically, the upper part of the surface layer is grayish brown channery loam about 5 inches thick. The next layer is brown very channery loam about 4 inches thick. The underlying material is very pale brown extremely flaggy loam 7 inches thick. Hard sandstone is at a depth of 16 inches. Depth to hard sandstone or hard shale ranges from 10 to 20 inches.

Permeability of the Rentsac soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate to high.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used as woodland.

The potential plant community on this unit is mainly pinyon and juniper with an understory of beardless wheatgrass, Indian ricegrass, serviceberry, mountainmahogany, sedges, and big sagebrush. The potential production of the native understory vegetation in normal years is about 400 pounds of air-dry vegetation per acre.

This unit is well suited to pinyon and juniper trees. Woodland products such as firewood, fenceposts, and Christmas trees are available. Because of the steepness of slope, generally only areas of the unit on foot slopes and ridges are accessible for harvesting of trees. Thinning the pinyon and juniper trees increases the production of understory forage plants.

This map unit is in capability subclass VIe, nonirrigated. It is in Pinyon-Juniper woodland site.

71—Redrob loam. This deep, somewhat poorly drained soil is on alluvial valley floors, low terraces, and flood plains. It formed in mixed alluvium. Slope is 0 to 3 percent. Areas are elongated and are 20 to 80 acres. The native vegetation is mainly cottonwood trees with an understory of shrubs and grasses. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the upper part of the surface layer is grayish brown light loam about 4 inches thick. The lower part is grayish brown loam about 13 inches thick. The next layer is grayish brown, stratified loam, sandy loam, and loamy sand 18 inches thick. The underlying material to a depth of 60 inches or more is brown very gravelly and cobbly loamy sand and sand.

Included in this unit are small areas of Fluvaquents, frequently flooded; Curecanti very cobbly loam; Kobar silty clay loam; Redrob Variant loam; Shawa loam; and Shawa loam, wet. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Redrob soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more for water-tolerant plants, but it is limited to depths between 20 and 40 inches for non-water-tolerant plants. Runoff is medium, and the hazard of water erosion is slight. A high water table is at a depth of 18 to 48 inches year-round. This soil is subject to brief periods of flooding in May to July. Ice jams also cause flooding during prolonged cold periods in winter.

This unit is used for irrigated hay and pasture and for wildlife habitat.

This unit is well suited to irrigated hay and pasture. The main limitations are the restricted rooting depth for non-water-tolerant plants and a short growing season. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the unit. Leveling helps to insure the uniform application of water.

This unit provides food and cover for waterfowl and wetland wildlife.

This unit is poorly suited to urban development. The main limitations are depth to the water table and the hazard of flooding.

This map unit is in capability subclass IIIw. It is in Riverbottom range site.

72—Redrob Variant loam. This deep, somewhat poorly drained soil is on alluvial valley floors, low terraces, and flood plains. It formed in mixed alluvium. Slope is 0 to 3 percent. Areas are irregular and elongated in shape and are 10 to 50 acres in size. The native vegetation is mainly meadow grasses and sedges. Elevation is 7,100 to 8,500 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 80 days.

Typically, the surface layer is very dark gray loam 3 inches thick. The subsoil is black loam 12 inches thick. The underlying material to a depth of 60 inches or more is stratified, grayish brown very gravelly loamy sand and brown very gravelly sand. In some areas the surface layer is sandy loam or sandy clay loam.

Included in this unit are small areas of Fluvaquents, frequently flooded; Curecanti very cobbly loam; Delson and Perma soils; and Redrob and Silas loams. Also included are small areas of soils that are similar to this Redrob Variant soil but are shallower or deeper over gravelly loamy sand. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Redrob Variant soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more for water-tolerant plants, but it is limited to depths between 10 and 40 inches for non-water-tolerant plants. Runoff is medium, and the hazard of water erosion is slight. A high water table is at a depth of 24 to 48 inches year-round. This soil is subject to brief periods of flooding in May through July.

This unit is used for irrigated hay and pasture and for wildlife habitat.

This unit is well suited to irrigated hay and pasture. The main limitations are the restricted rooting depth for non-water-tolerant plants and a short growing season. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill.

Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leveling helps to insure the uniform application of water.

This map unit is in capability subclass VIw. It is in Mountain Meadow range site.

73—Rentsac channery loam, 5 to 50 percent slopes. This shallow, well drained soil is on ridges, foothills, and side slopes. It formed in residuum derived dominantly from calcareous sandstone. Areas are elongated and are 200 to 5,000 acres. The native vegetation is mainly pinyon, juniper, brush, and grasses. Elevation is 6,000 to 7,600 feet. The average annual precipitation is 14 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is grayish brown channery loam about 5 inches thick. The next layer is very channery loam about 4 inches thick. The underlying material is extremely flaggy light loam 7 inches thick. Hard sandstone is at a depth of 16 inches. Depth to sandstone ranges from 10 to 20 inches.

Included in this unit are small areas of Blazon channery loam, Forelle loam, Moyerson stony clay loam, Piceance loam, Redcreek fine sandy loam, and Yamac loam. Also included are small areas of soils that are similar to this Rentsac soil but are less than 10 inches deep and small areas of Rock outcrop. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Rentsac soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate to very high.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used as woodland.

The potential plant community on this unit is mainly pinyon and Utah juniper with an understory of Indian ricegrass, beardless wheatgrass, mountainmahogany, and prairie junegrass. Smaller amounts of big sagebrush, bitterbrush, and serviceberry commonly are also present in the potential plant community. The potential

production of the native understory vegetation in normal years is about 500 pounds of air-dry vegetation per acre.

This unit is used extensively as winter habitat for mule deer and summer habitat for many small animals and birds.

This unit is well suited to the production of pinyon and juniper trees for use as firewood, fenceposts, and Christmas trees. Because of the steepness of slope, only the foot slopes and ridges generally are accessible for harvesting of trees. Thinning the pinyon and juniper trees increases the production of understory forage plants.

This map unit is in capability subclass VIIe, nonirrigated. It is in Pinyon-Juniper woodland site.

74—Rentsac-Moyerson-Rock outcrop complex, 5 to 65 percent slopes. This map unit is on foothills and ridges. Areas are irregular in shape and are 160 to 5,000 acres in size. The native vegetation is mainly pinyon and juniper trees with an understory of shrubs and grasses. Elevation is 5,800 to 7,200 feet. The average annual precipitation is 13 to 16 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 75 to 105 days.

This unit is 40 percent Rentsac channery loam that has slopes of 5 to 50 percent, 25 percent Moyerson stony clay loam that has slopes of 15 to 65 percent, and 20 percent Rock outcrop that has slopes of 5 to 65 percent. The Moyerson soil is mainly in the lower lying areas of the unit. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Blazon channery clay loam, Bulkley channery silty clay loam, Dollard silty clay loam, Redcreek sandy loam, and Yamac loam. Also included are small areas of soils that are similar to the Rentsac and Moyerson soils but are moderately deep to sandstone or shale. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Rentsac soil is shallow and well drained. It formed in residuum derived dominantly from sandstone. Typically, the surface layer is grayish brown channery loam about 5 inches thick. The next layer is brown very channery loam about 4 inches thick. The underlying material is very pale brown extremely flaggy loam 7 inches thick. Sandstone is at a depth of 16 inches. Depth to sandstone ranges from 10 to 20 inches. In some areas the surface layer is quite variable in texture.

Permeability of the Rentsac soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate to very high.

The Moyerson soil is shallow and well drained. It formed in residuum derived dominantly from shale. Typically, the surface layer is light gray stony clay loam about 2 inches thick. The next layer is gray clay loam about 8 inches thick. The underlying material is gray clay 7 inches thick. Shale is at a depth of 17 inches. Depth to shale ranges from 10 to 20 inches. In some areas the surface layer is silty clay loam, silty clay, light clay, or bouldery clay loam.

Permeability of the Moyerson soil is slow. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is very high.

Rock outcrop consists of ridge caps, ridge points, and long vertical bluffs 3 to 25 feet thick and 25 to 1,500 feet long.

Most areas of this unit are used for livestock grazing, woodland, and wildlife habitat. A few areas are used for coal mining and natural gas production.

The potential plant community on the Rentsac soil is mainly pinyon and juniper trees with a sparse understory of Indian ricegrass, beardless wheatgrass, mountainmahogany, big sagebrush, prairie junegrass, and bitterbrush. The potential plant community on the Moyerson soil is mainly Salina wildrye, shadscale, Sandberg bluegrass, Indian ricegrass, galleta, and bottlebrush squirreltail. The production of forage is limited by low precipitation, restricted rooting depth, and steepness of slope. The potential production of the native understory vegetation in normal years is about 600 pounds of air-dry vegetation per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this soil are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of stones on the surface, steepness of slope, low precipitation, and shallow rooting depth.

Slope limits access by livestock and results in overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The Rentsac soil is well suited to the production of pinyon and juniper for use as firewood, fenceposts, and Christmas trees. Because of the steepness of slope, only the foot slopes and ridges generally are accessible for harvesting of trees. Thinning the pinyon and juniper trees increases the production of understory forage plants.

This unit is used extensively as winter range for mule deer and some elk.

This unit is poorly suited to urban development. The main limitations are steepness of slope and the shallow depth to bedrock.

This map unit is in capability subclass VIIe, nonirrigated. The Rentsac soil is in Pinyon-Juniper

woodland site, and the Moyerson soil is in Clayey Slopes range site.

75—Rentsac-Piceance complex, 2 to 30 percent slopes. This map unit is on uplands, broad ridges, and foothills. Areas are oval and are 20 to 500 acres. The native vegetation is mainly sparse stands of pinyon and juniper and open areas of sagebrush. Elevation is 6,000 to 7,600 feet. The average annual precipitation is 14 to 18 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

This unit is 60 percent Rentsac channery loam that has slopes of 8 to 30 percent and 30 percent Piceance fine sandy loam that has slopes of 2 to 15 percent. The Piceance soil generally is on north-facing side slopes and is in more concave areas than the Rentsac soil. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Forelle loam, Redcreek sandy loam, and Yamac loam. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Rentsac soil is shallow and well drained. It formed in residuum derived dominantly from sandstone. Typically, the surface layer is grayish brown channery loam about 5 inches thick. The next layer is brown, strongly calcareous very channery loam about 4 inches thick. The underlying material is very pale brown extremely flaggy light loam 7 inches thick. Hard sandstone is at a depth of 16 inches. Depth to sandstone ranges from 10 to 20 inches. In some areas the surface layer is flaggy loam.

Permeability of the Rentsac soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate to high.

The Piceance soil is moderately deep and well drained. It formed in eolian material and colluvium derived dominantly from sandstone. Typically, the surface layer is brown fine sandy loam 4 inches thick. The upper 5 inches of the subsoil is brown loam, and the lower 13 inches is light yellowish brown loam. The substratum is very pale brown channery light loam 8 inches thick. Hard sandstone is at a depth of 30 inches. Depth to sandstone or hard shale ranges from 20 to 40 inches. In some areas the surface layer is loam or sandy loam.

Permeability of the Piceance soil is moderate. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is slow to medium, and the hazard of water erosion is slight to moderate.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used as woodland.

The potential plant community on the Rentsac soil is mainly pinyon and juniper trees with a sparse understory of Indian ricegrass, beardless wheatgrass, mountainmahogany, big sagebrush, prairie junegrass, and bitterbrush. The potential production of the native understory vegetation in normal years is about 500 pounds of air-dry vegetation per acre.

The potential plant community on the Piceance soil is mainly bluebunch wheatgrass, western wheatgrass, Utah serviceberry, big sagebrush, prairie junegrass, and sand lupine. The production of forage is limited by low available water capacity and restricted rooting depth. The average annual production of air-dry vegetation is about 750 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this soil are proper range use, deferred grazing, and rotation grazing. Chaining the pinyon and juniper trees can increase the production of the understory forage plants. Following chaining, proper grazing management is needed to reduce soil erosion and to lengthen the lifespan of the clearings. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Brush management and seeding are suitable practices where slopes are less than 15 percent. Range seeding is suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. Seeding is most successful if done in conjunction with chaining. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

The Rentsac soil is well suited to the production of pinyon and juniper trees for use as firewood, fenceposts, and Christmas trees. Because of the steepness of slope, only the foot slopes and ridges generally are accessible for harvesting of trees. Thinning the pinyon and juniper trees increases the production of understory forage plants.

This unit is used extensively as winter range for mule deer and some elk.

The main limitations of this unit for urban development are depth to bedrock and slope.

This map unit is in capability subclass VIIe, nonirrigated. The Rentsac soil is in Pinyon-Juniper woodland site, and the Piceance soil is in Rolling Loam range site.

76—Rhone loam, 30 to 75 percent slopes. This deep, well drained soil is on mountainsides, upland ridges, and side slopes. It formed in residuum and colluvium derived dominantly from sandstone. Areas are

oval and are 20 to 300 acres. The native vegetation is mainly brush and grasses. Elevation is 7,600 to 8,600 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the upper part of the surface layer is dark grayish brown loam about 8 inches thick. The lower part is dark grayish brown loam about 16 inches thick. The next layer is grayish brown very channery loam 16 inches thick. The underlying material is brown very channery loam 10 inches thick. Fractured sandstone is at a depth of 50 inches. Depth to sandstone ranges from 40 to 60 inches.

Included in this unit are small areas of Irigul channery loam, Parachute loam, Northwater loam, Silas loam, and Starman and Vandamore soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Rhone soil is moderate. Available water capacity is high. Effective rooting depth is 40 to 60 or more inches. Runoff is medium, and the hazard of water erosion is very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Columbia needlegrass, elk sedge, serviceberry, and Gambel oak. Smaller amounts of mountain brome, big sagebrush, and snowberry commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 2,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community.

This unit is used extensively as habitat for mule deer and grouse from late in spring to late in fall.

This map unit is in capability subclass VIIe, nonirrigated. It is in Brushy Loam range site.

77—Rhone-Northwater-Lamphier loams, 3 to 50 percent slopes. This map unit is on mountainsides and valley sides. Areas are irregular in shape and are 40 to 500 acres in size. The native vegetation is mainly aspen, brush, and grasses. Elevation is 7,400 to 8,600 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 40 percent Rhone loam that has slopes of 3 to 50 percent, 30 percent Northwater loam that has slopes of 3 to 50 percent, and 20 percent Lamphier loam that has slopes of 8 to 35 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Burnette, Cochetopa, Jerry, and Silas loams. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Rhone soil is deep and well drained. It formed in residuum and colluvium derived dominantly from sandstone. Typically, the upper part of the surface layer is dark grayish brown loam about 8 inches thick. The lower part is dark grayish brown loam about 16 inches thick. The next layer is grayish brown very channery loam 16 inches thick. The underlying material is brown very channery loam 10 inches thick. Fractured sandstone is at a depth of 50 inches. Depth to sandstone or shale ranges from 40 to 60 inches.

Permeability of the Rhone soil is moderate. Available water capacity is high. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is slight to very high.

The Northwater soil is deep and well drained. It formed in residuum derived dominantly from sandstone. Typically, the upper part of the surface layer is grayish brown loam about 4 inches thick. The lower part is grayish brown loam about 16 inches thick. The upper 5 inches of the subsoil is brown loam, and the lower 16 inches is pale brown very channery sandy clay loam. The substratum is light yellowish brown very channery loam 6 inches thick. Fractured sandstone is at a depth of 47 inches. Depth to sandstone ranges from 40 to 60 inches.

Permeability of the Northwater soil is moderate. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches. Runoff is medium, and the hazard of water erosion is slight to very high.

The Lamphier soil is deep and well drained. It formed in alluvium and colluvium derived dominantly from sandstone. Typically, the surface is covered with a mat of partially decomposed leaves and twigs 2 inches thick. Typically, the upper part of the surface layer is brown loam about 4 inches thick. The lower part is brown loam about 22 inches thick. The upper 16 inches of the underlying material is reddish brown loam, and the lower part to a depth of 60 inches or more is reddish brown loam. In some areas the surface layer is fine sandy loam.

Permeability of the Lamphier soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for firewood production.

Figure 5.—Typical area of Rock outcrop. Patent soils in foreground and on toe slopes; Blazon and Rentsac soils under pinyon and juniper in left center.

The potential plant community on the Rhone soil is mainly mountain brome, Columbia needlegrass, elk sedge, serviceberry, snowberry, and some Gambel oak. The potential plant community on the Northwater and Lamphier soils is mainly aspen woodland with an understory of mountain brome, nodding brome, Colorado blue wildrye, Kentucky bluegrass, bentgrass, and beardless wheatgrass. Smaller amounts of serviceberry, snowberry, chokecherry, sweet anise, meadowrue, and Rocky Mountain maple commonly are also present in the potential plant community. The production of forage is limited by competition from aspen and brush. The average annual production of air-dry vegetation is about 2,250 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of the high cost of removing the aspen and brush. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Some of the aspen trees on the Northwater and Lamphier soils are harvested as firewood.

This unit is a good source of topsoil.

This map unit is in capability subclass VIIe, nonirrigated. The Rhone soil is in the Brushy Loam range

site, and the Northwater and Lamphier soils are in Aspen woodland site.

78—Rock outcrop. This map unit is on mountains, in canyons, and on ridges, hills, and upland breaks (fig. 5). It consists of barren exposures of sandstone, hard shale, siltstone, or limestone. Slope is about 50 to 100 percent. Areas are irregular, rectangular, or elongated in shape and are 15 to 200 acres in size. Elevation is 5,100 to 9,600 feet. The average annual precipitation is 8 to 20 inches, the average annual air temperature is 38 to 50 degrees F, and the average frost-free period is 45 to 130 days.

This unit is 90 percent or more exposed bedrock with some soil material in the crevices and at the base of the slopes. Accumulations of boulders and stones are also common at the base of the slopes. Rock outcrop most commonly occurs as nearly vertical ledges and cliffs that are 3 to 50 feet high and 5 to 1,500 feet long.

Included in this unit, south and west of the town of Rangely, are several gently sloping to steep, large sandstone ridges and mountaintops.

Use of areas of this unit is limited. Some wildlife use the areas for shelter and cover.

This map unit is in capability class VIII.

79—Shawa loam, 1 to 3 percent slopes. This deep, well drained soil is on alluvial valley floors, fans, and low terraces and along concave drainageways. It formed in mixed alluvium. Areas are long and narrow and are 20 to 160 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 6,000 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the upper part of the surface layer is dark grayish brown loam about 9 inches thick. The lower part is grayish brown clay loam about 7 inches thick. The next layer is brown clay loam 28 inches thick. The underlying material to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is fine sandy loam, clay loam, or gravelly loam.

Included in this unit are small areas of Dollard and Kobar silty clay loams, Redrob loam, and Zoltay clay loam. Also included are small areas of soils that are similar to this Shawa soil but are moderately deep to bedrock or contrasting soil material. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Shawa soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

This unit is used as irrigated and nonirrigated cropland and for livestock grazing and wildlife habitat. Hay and pasture are the main irrigated crops, and wheat is the main nonirrigated crop.

This unit is suited to irrigated hay and pasture. It has few limitations. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for nonirrigated small grain crops, the main limitations are a short growing season and low precipitation in summer. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. It also helps to conserve moisture and control erosion.

The potential plant community on this unit is mainly western wheatgrass, muttongrass, basin wildrye, low rabbitbrush, big sagebrush, and serviceberry. Smaller amounts of needleandthread, bluebunch wheatgrass, and snowberry commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 1,200 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This soil is well suited as a source of topsoil.

This map unit is in capability subclasses IIIe, irrigated, and IIIc, nonirrigated. It is in Deep Loam range site.

80—Shawa loam, 3 to 8 percent slopes. This deep, well drained soil is on alluvial valley floors, fans, and low terraces and along concave drainageways. It formed in mixed alluvium. Areas are elongated and are 20 to 150 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 6,000 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the upper part of the surface layer is dark grayish brown loam about 9 inches thick. The lower part

is grayish brown clay loam about 7 inches thick. The next layer is brown clay loam 28 inches thick. The underlying material to a depth of 60 inches or more is pale brown loam. In some areas the surface layer is fine sandy loam, clay loam, or gravelly loam.

Included in this unit are small areas of Dollard and Kobar silty clay loams and Zoltay clay loam. Also included are small areas of soils that are similar to this Shawa soil but are moderately deep to bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Shawa soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to moderate.

This unit is used as irrigated and nonirrigated cropland and for livestock grazing and wildlife habitat. Hay and pasture are the main irrigated crops, and wheat is the main nonirrigated crop.

This unit is suited to irrigated hay and pasture. It has few limitations. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Irrigation water can be applied by the furrow, corrugation, and sprinkler methods. Leveling helps to insure the uniform application of water.

Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

If this unit is used for nonirrigated small grain crops, the main limitations are a short growing season and low precipitation in summer. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. It also helps to conserve moisture and control water erosion.

The potential plant community on this unit is mainly western wheatgrass, muttongrass, basin wildrye, low rabbitbrush, big sagebrush, and serviceberry. Smaller amounts of needleandthread, bluebunch wheatgrass, and snowberry commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 1,200 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is well suited as a source of topsoil.

This map unit is in capability subclasses IVe, irrigated, and IIIe, nonirrigated. It is in Deep Loam range site.

81—Shawa loam, wet, 0 to 5 percent slopes. This deep, somewhat poorly drained soil is on alluvial valley floors, fans, and terraces and along drainageways. It has a seasonal high water table at a depth of 24 to 48 inches. It formed in mixed alluvium. Areas are irregular in shape and are 40 to 350 acres in size. The native vegetation is mainly sedges and grasses. Elevation is 6,000 to 7,000 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the upper part of the surface layer is dark grayish brown loam about 8 inches thick. The lower part is grayish brown clay loam about 20 inches thick. The upper 14 inches of the underlying material is grayish brown silty clay loam, and the lower part to a depth of 60 inches or more is light brownish gray clay loam. Gravel and cobbles are on the surface in some areas. In some areas the surface layer is clay loam, silty clay loam, or fine sandy loam.

Included in this unit are small areas of Havre loam, Kobar silty clay loam, Redrob loam, and Shawa loam. Also included are small areas of soils that are similar to this Shawa soil but have a clayey or sandy substratum. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Shawa soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches for water-tolerant plants but is limited to depths between 20 and 40 inches for non-water-tolerant plants. A seasonal high water table is at a depth of 24 to 48 inches. Runoff is medium, and the hazard of water erosion is slight. The soil is subject to brief periods of flooding early in summer.

This unit is used mainly for irrigated hay and pasture. It is also used for livestock grazing and wildlife habitat.

This unit is well suited to hay and pasture. The main limitations are a short growing season and wetness. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leveling helps to insure the uniform application of water.

Compaction and excessive cloddiness occur if the soil in this unit is cultivated when it is too moist. Wetness

limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill.

Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

The potential plant community on this unit is mainly basin wildrye, western wheatgrass, slender wheatgrass, sedges, rushes, and herbaceous sage. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

If the range vegetation is seriously deteriorated, seeding is needed. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is poorly suited to urban development. The main limitations are the seasonal high water table and the hazard of flooding.

This map unit is in capability subclasses IIIw, irrigated, and Vw, nonirrigated. It is in Swale Meadow range site.

82—Silas loam, 0 to 8 percent slopes. This deep, well drained soil is on the bottoms of narrow mountain valleys. It formed in mixed alluvium. Areas are long and narrow and are 20 to 100 acres. The native vegetation is mainly grasses and shrubs. Elevation is 7,300 to 8,500 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the upper part of the surface layer is dark gray loam about 4 inches thick. The lower part is dark gray loam about 20 inches thick. The underlying material to a depth of 60 inches or more is stratified, dark gray loam and dark gray sandy clay loam.

Included in this unit are small areas of Barcus channery loamy sand, Curecanti very cobbly loam, Glendive fine sandy loam, Havre loam, and Shawa loam. Also included are small areas of soils that are similar to this Silas soil but have a sandy loam surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Silas soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to moderate. A water table is at a depth of 48 to 72 inches in spring and early in summer.

This unit is used for livestock grazing, irrigated hay and pasture, and wildlife habitat.

The potential plant community on this unit is mainly basin wildrye, slender wheatgrass, Letterman needlegrass, and western wheatgrass. Smaller amounts of rabbitbrush, big sagebrush, western yarrow, and Columbia needlegrass commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 2,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

If the range vegetation is seriously deteriorated, seeding is needed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. For successful seeding, prepare a seedbed and drill in the seed.

This unit is well suited to hay and pasture. The main limitation is a short growing season. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This unit is used extensively as habitat for small game animals and birds in summer and as range for mule deer and elk in winter.

This unit is well suited as a source of topsoil.

This map unit is in capability subclass VIe. It is in Mountain Swale range site.

83—Silas loam, 8 to 12 percent slopes. This deep, well drained soil is on the bottoms and side slopes of narrow mountain valleys. It formed in mixed alluvium. Areas are long and narrow and are 20 to 80 acres. The native vegetation is mainly grasses and shrubs. Elevation is 7,300 to 8,500 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

Typically, the upper part of the surface layer is dark grayish loam about 4 inches thick. The lower part is dark gray loam about 20 inches thick. The underlying material to a depth of 60 inches or more is stratified, dark gray loam and sandy clay loam.

Included in this unit are small areas of Barcus channery loamy sand, Curecanti very cobbly loam, Glendive fine sandy loam, Havre loam, and Shawa loam.

Also included are small areas of soils that are similar to this Silas soil but have a sandy loam or gravelly loam surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Silas soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly basin wildrye, slender wheatgrass, Letterman needlegrass, and big sagebrush. Smaller amounts of western wheatgrass, rabbitbrush, western yarrow, and Columbia needlegrass commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 2,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If the range vegetation is seriously deteriorated, seeding is needed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. For successful seeding, prepare a seedbed and drill in the seed.

This unit is used extensively as habitat for small game animals and birds in summer and as range for mule deer and elk in winter.

This unit is well suited as a source of topsoil.

This map unit is in capability subclass VIe. It is in Mountain Swale range site.

84—Silas Variant loam. This deep, well drained soil is on alluvial valley floors, on fans, and in swales on terraces. It formed in mixed alluvium. Slope is 1 to 3 percent. Areas are long and narrow or irregular in shape and are 20 to 150 acres in size. The native vegetation is mainly grasses and low shrubs. Elevation is 7,000 to 7,500 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the upper part of the surface layer is grayish brown loam about 6 inches thick. The lower part is grayish brown loam about 14 inches thick. The underlying material to a depth of 60 inches or more is stratified, grayish brown and dark gray loam, silty clay loam, and clay loam.

Included in this unit are small areas of Hagga and Shawa loams. Also included are small areas of soils that are similar to this Silas Variant soil but have a sandy loam or clay loam surface layer. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of the Silas Variant soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. A seasonal high water table is at a depth of 42 to 60 inches in spring and early in summer. This soil is subject to rare periods of flooding.

This unit is used for hay and pasture, livestock grazing, and wildlife habitat.

This unit is well suited to hay and pasture. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leveling helps to insure the uniform application of water.

Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

The potential plant community on this unit is mainly basin wildrye, western wheatgrass, Columbia needlegrass, and big sagebrush. Smaller amounts of slender wheatgrass, western yarrow, and Douglas rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 2,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management.

If the range vegetation is seriously deteriorated, seeding is needed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. For successful seeding, prepare a seedbed and drill in the seed.

This unit is well suited as a source of topsoil.

This map unit is in capability subclasses IIIe, irrigated, and IIIc, nonirrigated. It is in Mountain Swale range site.

85—Sinkson gravelly sandy loam, 1 to 8 percent slopes. This deep, well drained soil is on toe slopes, fans, and valley sides. It formed in colluvium and alluvium derived dominantly from red-bed micaceous

sandstone. Areas are irregular in shape and are 20 to 160 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 6,300 to 7,500 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 80 to 100 days.

Typically, the surface layer is reddish brown gravelly sandy loam 3 inches thick. The underlying material to a depth of 60 inches or more is reddish brown gravelly loam. The soil is calcareous throughout. In some areas the surface layer is gravelly loam.

Included in this unit are small areas of Curecanti very cobbly loam and Redrob and Shawa loams. Also included are small areas of soils that are similar to this Sinkson soil but have more or fewer rock fragments and soils that are moderately deep to bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Sinkson soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to moderate.

This unit is used for livestock grazing, irrigated hay and pasture, and wildlife habitat.

The potential plant community on this unit is mainly bluebunch wheatgrass, Indian ricegrass, needleandthread, serviceberry, big sagebrush, and bitterbrush. Smaller amounts of western wheatgrass, muttongrass, low rabbitbrush, and snowberry commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 1,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. The main limitations for seeding are a short growing season, gravel on the surface, and low precipitation in summer. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is well suited to hay and pasture. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Irrigation water can be applied by the furrow, corrugation, and sprinkler methods. Leveling helps to insure the uniform application of water.

Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This map unit is in capability subclass IVe. It is in Loamy Slopes range site.

86—Sinkson gravelly sandy loam, 8 to 15 percent slopes. This deep, well drained soil is on toe slopes, fans, and valley sides. It formed in colluvium and alluvium derived dominantly from red-bed micaceous sandstone. Areas are elongated and are 20 to 100 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 6,300 to 7,500 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 80 to 100 days.

Typically, the surface layer is reddish brown gravelly sandy loam 3 inches thick. The underlying material to a depth of 60 inches or more is reddish brown gravelly loam. The soil is calcareous throughout. In some areas the surface layer is stony.

Included in this unit are small areas of Shawa loam, Torriorthents, and Rock outcrop. Also included are small areas of soils that are similar to this Sinkson soil but have more or fewer rock fragments. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Sinkson soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly bluebunch wheatgrass, Indian ricegrass, serviceberry, needleandthread, big sagebrush, and bitterbrush. Smaller amounts of western wheatgrass, muttongrass, low rabbitbrush, and snowberry commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 850 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass IVe. It is in Loamy Slopes range site.

87—Starman-Vandamore complex, 5 to 40 percent slopes. This map unit is on rolling ridges and windswept ridgetops. Areas are irregular in shape and are 20 to 300 acres in size. The native vegetation is mainly grasses and low shrubs. Elevation is 7,500 to 8,900 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 50 percent Starman channery loam that has slopes of 5 to 30 percent and 40 percent Vandamore channery loam that has slopes of 5 to 40 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Irigul channery loam, Parachute loam, and Rhone loam. Also included are small areas of Rock outcrop and soils that are similar to the Starman and Vandamore soils but have fewer rock fragments. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Starman soil is shallow and well drained. It formed in residuum derived dominantly from hard shale. Typically, the surface layer is grayish brown channery loam 2 inches thick. The upper 6 inches of the underlying material is pale brown extremely channery loam, and the lower part is very pale brown extremely channery loam 9 inches thick. Hard shale is at a depth of 17 inches. Depth to hard shale ranges from 10 to 20 inches.

Permeability of the Starman soil is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate to very high. The hazard of soil blowing is moderate to high.

The Vandamore soil is moderately deep and well drained. It formed in residuum derived dominantly from sandstone. Typically, the surface layer is light brownish gray channery loam about 4 inches thick. The next layer is light brownish gray very channery loam about 4 inches thick. The underlying material is very pale brown extremely channery loam 17 inches thick. Sandstone is at a depth of 25 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability of the Vandamore soil is moderate. Available water capacity is very low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate to very high. The hazard of soil blowing is moderate to high. Prevailing winds sweep most of the snow cover off the soils in this unit in winter.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly beardless wheatgrass, streambank wheatgrass, fringed sagebrush, mat penstemon, mat laco, and Colorado buckwheat. Smaller amounts of Indian ricegrass, prairie junegrass, sedge, muttongrass, and low rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season. The average annual production of air-dry vegetation is about 350 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. The suitability of the unit for rangeland seeding is poor. Livestock grazing should be managed to protect the soil in this unit from excessive erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This unit is used extensively for its scenic value and as habitat for wild horses.

This map unit is in capability subclass VIIe. It is in Dry Exposure range site.

88—Tampico-Miracle complex, 8 to 50 percent slopes. This map unit is on mountainsides, ridges, side slopes, and hills. Areas are irregular in shape and are 100 to 1,000 acres in size. The native vegetation is mainly mountain brush and grasses on the Tampico soil and low shrubs and grasses on the Miracle soil. Elevation is 7,200 to 8,500 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 55 percent Tampico loam that has slopes of 15 to 50 percent and 35 percent Miracle fine sandy loam that has slopes of 8 to 25 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Kamack loam, Lamphier loam, and Rock outcrop. Rock outcrop consists of small ridge crests, ridge points, bluffs, and ledges. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Tampico soil is deep and well drained. It formed in colluvium and alluvium derived dominantly from red-bed sandstone and shale. Typically, the surface is

covered with a mat of partially decomposed leaves and twigs 3 inches thick. The upper part of the surface layer is dark reddish gray loam about 11 inches thick, and the lower part is reddish gray loam about 4 inches thick. The upper 15 inches of the subsoil is reddish brown loam, and the lower 12 inches is reddish brown clay loam. The substratum to a depth of 60 inches or more is reddish brown cobbly clay loam. The rock fragments are angular in shape.

Permeability of the Tampico soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to very high.

The Miracle soil is moderately deep and well drained. It formed in colluvium and residuum derived dominantly from red-bed sandstone. Typically, the upper part of the surface layer is dark reddish gray fine sandy loam about 8 inches thick. The lower part is reddish brown loam about 7 inches thick. The upper 7 inches of the subsoil is reddish brown loam, and the lower 5 inches is reddish brown sandy clay loam. Highly weathered and fractured sandstone that breaks down easily is at a depth of 27 inches. Hard sandstone is at a depth of 32 inches. Depth to hard sandstone ranges from 20 to 40 inches. In some areas the surface layer is loam.

Permeability of the Miracle soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate to high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Tampico soil is mainly Gambel oak, serviceberry, mountain brome, elk sedge, snowberry, and slender wheatgrass. Smaller amounts of chokecherry, Columbia needlegrass, and rose commonly are also present in the potential plant community. The potential plant community on the Miracle soil is mainly Idaho fescue, Letterman needlegrass, mountain brome, big sagebrush, low rabbitbrush, and serviceberry. Smaller amounts of Columbia needlegrass, slender wheatgrass, and snowberry commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Slope limits access by livestock and results in overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Brush management and seeding are suitable practices where slopes are less than 15 percent. The main limitations for seeding are a short growing season, competition from brush and shrubs, and steepness of slope. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass VIIe, nonirrigated. The Tampico soil is in Brushy Loam range site, and the Miracle soil is in Mountain Loam range site.

89—Tisworth fine sandy loam, 0 to 5 percent slopes. This deep, well drained soil is on valley floors and broad fans. It formed in alluvium derived dominantly from sedimentary rock with a high content of gypsum and alkaline salt. Areas are elongated and are 30 to 300 acres. The native vegetation is mainly salt-tolerant shrubs and grasses. Elevation is 5,800 to 7,000 feet. The average annual precipitation is 13 to 15 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is pale brown fine sandy loam 4 inches thick. The subsoil is light yellowish brown clay loam 7 inches thick. The upper 9 inches of the underlying material is very pale brown fine sandy loam that has fine crystals and seams of gypsum and calcium carbonate, and the lower part to a depth of 60 inches or more is very pale brown fine sandy loam. In some areas the surface layer is loam or clay loam.

Included in this unit are small areas of Absher and Havre loams, Kobar silty clay loam, Moyerson clay loam, and Patent and Trembles loams. Also included are small areas of soils that are similar to this Tisworth soil but are severely gullied and soils that have slightly steeper slopes. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Tisworth soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is moderate.

This unit is used for livestock grazing, irrigated hay and pasture, and wildlife habitat.

The potential plant community on this unit is mainly greasewood, big sagebrush, Nevada bluegrass, western wheatgrass, bottlebrush squirreltail, and shadscale. Smaller amounts of winterfat and rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by low precipitation, rapid runoff, alkalinity, and a short growing season. The average annual production of air-dry vegetation is about 600 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less

preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing shoud be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Livestock grazing should be managed to protect the soil from excessive erosion.

If this unit is seeded, the main limitations are low precipitation in summer, alkalinity, and the hazard of erosion. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Salt- and alkali-tolerant grasses are best suited to this unit.

If this unit is used for irrigated hay and pasture, the main limitations are salinity and alkalinity, slow permeability, and difficulty of brush removal. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leveling helps to insure the uniform application of water. Water needs to be applied at a slow rate over a long period to insure that the root zone is properly wetted.

Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This map unit is in capability subclasses IVs, irrigated, and VIIs, nonirrigated. It is in Alkaline Slopes range site.

90—Torrifluvents, gullied. This map unit is along narrow valley bottoms, in swales, and on eroded fans. Slope is 0 to 5 percent. Areas are long and narrow or irregular in shape and are 40 to 200 acres in size. The native vegetation is mainly sparse desert shrubs and annual grasses. Elevation is 5,100 to 7,000 feet. The average annual precipitation is 8 to 16 inches, the average annual air temperature is 40 to 50 degrees F, and the average frost-free period is 75 to 130 days.

This unit is 80 percent Torrifluvents that are characterized by gullies and headcuts 3 to 35 feet deep and 5 to 150 feet wide.

Torrifluvents are moderately deep and deep and are well drained and somewhat excessively drained. They formed in highly calcareous and gypsiferous, stratified sandy, loamy, and clayey alluvium derived dominantly from sandstone and shale.

Included in this unit are small areas of Absher loam, Billings silty clay loam, Chipeta silty clay loam, Glenton sandy loam, Havre loam, Tisworth fine sandy loam, Turley fine sandy loam, and Uffens loam.

Permeability of the Torrifluvents is moderately rapid to slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is very high, which results in high production of sediment during rainstorms and periods of snowmelt.

This unit is nearly barren, but a few areas are used for livestock grazing and wildlife habitat.

This map unit is in capability class VIII.

91—Torriorthents-Rock outcrop complex, 15 to 90 percent slopes. This map unit is in extremely rough and eroded areas on mountains, hills, ridges, and canyonsides. Slopes mainly face south. The native vegetation is mainly sparse shrubs and grasses with some pinyon and juniper trees. Elevation is 5,100 to 7,500 feet. The average annual precipitation is 8 to 18 inches, the average annual air temperature is 40 to 50 degrees F, and the average frost-free period is 70 to 130 days.

This unit is 50 percent Torriorthents that have slopes of 15 to 65 percent and 30 percent Rock outcrop that has slopes of 35 to 90 percent (fig. 6).

Included in this unit are small areas of Barcus channery loamy sand, Glendive fine sandy loam, Havre loam, Moyerson stony clay loam, Nihill channery sandy loam, Patent loam, Redcreek sandy loam, Rentsac channery loam, Sinkson gravelly sandy loam, and Blazon, Castner, and Clifterson channery loams.

Torriorthents are very shallow to moderately deep and are well drained and somewhat excessively drained. They formed in residuum and colluvium derived dominantly from sandstone, shale, limestone, and siltstone. Torriorthents are highly variable. No single profile of Torriorthents is typical, but one commonly observed in the survey area has a surface layer of pale brown channery loam about 3 inches thick. The underlying material is very pale brown channery loam, very channery loam, or fine sandy loam about 13 inches thick. Shale or sandstone is at a depth of 16 inches. Torriorthents are calcareous throughout. In some areas the surface layer is stony or flaggy.

Permeability of the Torriorthents is moderate. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is very rapid, and the hazard of water erosion is very high.

Rock outcrop consists of barren escarpments, ridge caps, and points of sandstone, shale, limestone, or siltstone. The escarpments are 3 to 50 feet thick and 25 to 2,500 feet long.

Most areas of this unit are used for wildlife habitat and livestock grazing.

The potential plant community on this unit is mainly some pinyon and juniper trees with Indian ricegrass, beardless wheatgrass, prairie junegrass, low rabbitbrush, and some forbs. Many areas have sparse stands of

pinyon and juniper trees, and other areas are nearly barren. The average annual production of air-dry vegetation is about 100 pounds per acre. Livestock grazing is limited by sparse vegetation and steepness of slope.

The pinyon and juniper trees have very little economic value. Some are used for firewood, fenceposts, and Christmas trees; however, in most areas steepness of slope limits access for the harvesting of wood products.

This unit is used extensively as winter range and cover for mule deer and elk, because it is mainly on south-facing side slopes and is open most of the winter.

This map unit is in capability subclass VIIe. It is in Stony Foothills range site.

92—Trembles loam, wet. This deep, moderately well drained soil is on alluvial valley floors, flood plains, and low stream terraces. It formed in mixed alluvium. Slope is 0 to 3 percent. Areas are elongated and are 20 to 200 acres. The native vegetation is mainly low shrubs and grasses and cottonwood trees and willows along major streams. Elevation is 5,800 to 6,200 feet. The average annual precipitation is 14 to 16 inches, the average annual air temperature is 42 to 45 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the upper part of the surface layer is light gray loam about 3 inches thick. The lower part is pale brown loam about 5 inches thick. The upper 12 inches of the underlying material is very pale brown fine sandy loam, the next 22 inches is very pale brown fine sandy loam, and the lower part to a depth of 60 inches or more is light gray fine sandy loam that has lenses of sandy loam. In some areas the surface layer is sandy loam or clay loam.

Included in this unit are small areas of Glendive fine sandy loam, Havre loam, Kobar silty clay loam, Patent loam, Redrob loam, and Tisworth fine sandy loam. Also included are small areas of soils that are similar to this Trembles soil, but the underlying material is very cobbly and gravelly sand. Included areas make up about 15

Figure 6.—Typical area of Torriorthents-Rock outcrop complex, 15 to 90 percent slopes. Glendive soils are on the colluvial and alluvial toe slopes and valley sides, Barcus soils are on the local outwash fan in foreground, and Havre and Hagga soils are on the alluvial bottom in right center.

percent of the total acreage. The percentage varies from one area to another.

Permeability of the Trembles soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. A seasonal high water table fluctuates between depths of 36 and 60 inches in spring. In low areas along the major river in the area, this soil is subject to brief periods of flooding in spring.

This unit is used for irrigated hay and pasture, livestock grazing, and wildlife habitat.

This unit is well suited to hay and pasture. The main limitation is the short growing season. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leveling helps to insure the uniform application of water.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Use of nitrogen and phosphorus fertilizer promotes good growth of forage plants.

If this unit is used for irrigated small grain crops, the main limitation is the short growing season.

The potential plant community on this unit is mainly western wheatgrass, slender wheatgrass, saltgrass, Kentucky bluegrass, and tall rabbitbrush. Smaller amounts of foxtail, basin wildrye, and some greasewood commonly are also present in the potential plant community. Cottonwood trees, willows, and cattails are common along streambanks and oxbows. The average annual production of air-dry vegetation is about 2,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclasses IIIe, irrigated, and IIIc, nonirrigated. It is in Salt Meadow range site.

93—Turley fine sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on fans, alluvial valley floors, and low terraces. It formed in calcareous mixed alluvium derived dominantly from sandstone and shale. Areas are elongated and are 20 to 500 acres. The native vegetation is mainly desert shrubs and grasses. Elevation is 5,000 to 5,800 feet. The average annual precipitation is 8 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 105 to 125 days.

Typically, the upper part of the surface layer is light brownish gray fine sandy loam about 4 inches thick. The next layer is light brownish gray loam about 10 inches thick. The upper 11 inches of the underlying material is light brownish gray loam, and the lower part to a depth of 60 inches or more is light brownish gray loam that has some salt crystals. In some areas the surface layer is sandy loam, loam, or very fine sandy loam.

Included in this unit are small areas of Billings silty clay loam, Glenton sandy loam, Kinnear fine sandy loam, Nihill channery sandy loam, and Uffens loam. Also included are small areas of soils that are similar to this Turley soil but are moderately deep to shale or sandstone and a few areas of Turley soils that are underlain by sand and gravel. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Turley soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The soil is calcareous throughout.

This unit is used mainly for livestock grazing and as irrigated cropland. It is also used for wildlife habitat and some urban development. Hay and pasture are the main irrigated crops.

The potential plant community on this unit is mainly galleta, Indian ricegrass, greasewood, big sagebrush, bud sagebrush, bottlebrush squirreltail, and Gardner saltbush. Smaller amounts of western wheatgrass, Douglas rabbitbrush, and winterfat commonly are also present in the potential plant community. The production of forage is limited by low precipitation, alkalinity, and salinity. The average annual production of air-dry vegetation is about 650 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. The main limitations for seeding are low precipitation in summer, alkalinity, and salinity. For successful seeding, prepare a seedbed and drill in the

seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is well suited to irrigated hay and pasture. The main limitation is availability of irrigation water. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leveling helps to insure the uniform application of water. The method used generally is governed by the crop grown.

Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This unit is well suited to most locally adapted crops. It is limited mainly by alkalinity and salinity. If the unit is irrigated, salinity influences the choice of crops.

Sprinkler irrigation is the most suitable method of applying water. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize the leaching of plant nutrients. To avoid overirrigating and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the crop needs. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate.

This unit is well suited to urban development. It has few limitations. Population growth has resulted in increased construction of homes on the unit.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated. It is in Alkaline Slopes range site.

94—Turley fine sandy loam, 3 to 8 percent slopes. This deep, well drained soil is on alluvial valley floors, fans, and low terraces. It formed in calcareous mixed alluvium derived dominantly from sandstone and shale. Areas are irregular in shape and are 20 to 500 acres in size. The native vegetation is mainly desert shrubs and grasses. Elevation is 5,000 to 5,800 feet. The average annual precipitation is 8 to 12 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 105 to 125 days.

Typically, the upper part of the surface layer is light brownish gray fine sandy loam about 4 inches thick. The next layer is light brownish gray loam about 10 inches thick. The upper 11 inches of the underlying material is light brownish gray loam, and the lower part to a depth of 60 inches or more is light brownish gray loam that has some salt crystals. In some areas the surface layer is sandy loam, loam, or very fine sandy loam.

Included in this unit are small areas of Glenton sandy loam, Kinnear fine sandy loam, Nihill channery sandy loam, and Uffens loam. Also included are small areas of soils that are similar to this Turley soil but are moderately deep to shale or sandstone and a few areas of Turley soils that are underlain by sand and gravel. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Turley soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to moderate. The soil is calcareous throughout.

This unit is used mainly for livestock grazing and wildlife habitat. It is also used for urban development.

The potential plant community on this unit is mainly galleta, Indian ricegrass, greasewood, big sagebrush, bud sagebrush, bottlebrush squirreltail, and Gardner saltbush. Smaller amounts of western wheatgrass, Douglas rabbitbrush, and winterfat commonly are also present in the potential plant community. The production of forage is limited by low precipitation, alkalinity, and salinity. The average annual production of air-dry vegetation is about 650 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is suitable if the range is in poor condition. The main limitations for seeding are low precipitation in summer, alkalinity, and salinity. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is well suited to urban development. It has few limitations. Population growth has resulted in increased construction of homes on the unit.

This map unit is in capability subclass VIe, nonirrigated. It is in Alkaline Slopes range site.

95—Uffens loam, 0 to 5 percent slopes. This deep, well drained soil is on fans and low terraces. It formed in calcareous, saline alluvium. Areas are irregular in shape and are 20 to 250 acres in size. The native vegetation is mainly salt-tolerant shrubs and grasses. Elevation is 5,100 to 5,800 feet. The average annual precipitation is 7 to 10 inches, the average annual air temperature is 45 to 50 degrees F, and the average frost-free period is 105 to 130 days.

Typically, the surface layer is very pale brown loam 2 inches thick. The upper 6 inches of the subsoil is light yellowish brown clay loam, and the lower 11 inches is very pale brown clay loam. The upper 5 inches of the

substratum is light yellowish brown loam, the next 4 inches is light yellowish brown loam, and the lower part to a depth of 60 inches or more is very pale brown loam.

Included in this unit are small areas of Billings silty clay loam, Colorow sandy loam, Nihill channery fine sandy loam, and Turley fine sandy loam. Also included are small areas of gullied land and slickspots. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Uffens soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The soil is calcareous throughout.

This unit is used for livestock grazing and wildlife habitat. It can be used for hay and pasture if irrigation water is made available.

The potential plant community on this unit is mainly big sagebrush, greasewood, galleta, western wheatgrass, sand dropseed, and bottlebrush squirreltail. Smaller amounts of winterfat, low rabbitbrush, Indian ricegrass, fourwing saltbush, mat saltbush, and Gardner saltbush commonly are also present in the potential plant community. The production of forage is limited by low precipitation and alkalinity. The average annual production of air-dry vegetation is about 500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. The main limitations for seeding are salinity, alkalinity, and low precipitation.

If this unit is used for hay and pasture, the main limitations are salinity, alkalinity, and slow permeability. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Irrigation water can be applied by the border and sprinkler methods. Leveling helps to insure the uniform application of water. Salt-tolerant grasses can be grown.

Annual applications of nitrogen and phosphorus fertilizer are needed to maintain production of high quality irrigated pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This map unit is in capability subclasses IVs, irrigated, and VIIs, nonirrigated. It is in Alkaline Slopes range site.

96—Veatch channery loam, 12 to 50 percent slopes. This moderately deep, well drained soil is on mountainsides. It formed in colluvium derived dominantly from sedimentary rock. Areas are irregular in shape and are 20 to 750 acres in size. The native vegetation is mainly brush, shrubs, and grasses. Elevation is 6,500 to 7,500 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 80 to 100 days.

Typically, the surface layer is dark brown channery loam 8 inches thick. The upper 5 inches of the subsoil is dark brown channery loam, and the lower 5 inches is brown channery loam. The underlying material is very pale brown extremely channery light loam 14 inches thick. Sandstone is at a depth of 32 inches. Depth to sandstone ranges from 20 to 40 inches. In some areas the surface layer is channery fine sandy loam.

Included in this unit are small areas of Castner channery loam, Glendive fine sandy loam, Redcreek sandy loam, Rentsac channery loam, and Rhone loam. Also included are small areas of soils that are similar to this Veatch soil but are deep, soils that are more than 35 percent rock fragments, and Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Veatch soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate to very high.

Most areas of this unit are used for livestock grazing and wildlife habitat. A few areas are used for development of natural gas wells.

The potential plant community on this unit is mainly bluebunch wheatgrass, western wheatgrass, muttongrass, big sagebrush, mountainmahogany, and serviceberry. Smaller amounts of Indian ricegrass, snowberry, needleandthread, and low rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season and competition from brush. The average annual production of air-dry vegetation is about 1,000 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Slope limits access by livestock and results in overgrazing of the less sloping areas. Trails or walkways can be constructed in places to encourage livestock to graze in areas where access is limited. Grazing should be delayed until the soil in the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

The suitability of this unit for rangeland seeding is poor. The main limitations for seeding are difficulty of brush removal and steepness of slope.

This unit is used extensively as winter range for mule deer.

This map unit is in capability subclass VIIe. It is in Loamy Slopes range site.

97—Walknolls channery sandy loam, 5 to 50 percent slopes. This shallow, well drained soil is on hills and ridges. It formed in residuum derived dominantly from sandstone. Areas are irregular in shape and are 40 to 1,000 acres in size. The native vegetation is mainly desert low shrubs and grasses. Elevation is 5,300 to 6,000 feet. The average annual precipitation is 7 to 10 inches, the average annual air temperature is 46 to 50 degrees F, and the average frost-free period is 105 to 135 days.

Typically, the surface layer is pale brown channery sandy loam 4 inches thick. The underlying material is extremely channery sandy loam 8 inches thick. Sandstone is at a depth of 12 inches. In some areas the surface layer is channery loam or flaggy sandy loam. Depth to sandstone ranges from 10 to 20 inches.

Included in this unit are small areas of Glenton sandy loam; Begay, Kinnear, Potts, and Turley fine sandy loams; and Uffens loam. Also included are small areas of Rock outcrop. Rock outcrop consists of ledges or points on crests of hills and ridges and along steep breaks. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Walknolls soil is moderately rapid. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate to very high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly galleta, Indian ricegrass, shadscale, and Douglas rabbitbrush. Smaller amounts of big sagebrush, needleandthread, and some Utah juniper trees commonly are also present in the potential plant community. The production of forage is limited by low precipitation and low available water capacity. The average annual production of air-dry vegetation is about 350 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of steepness of slope, shallow depth to bedrock, droughtiness, and low precipitation.

Brush management improves deteriorated areas of range that are producing more woody shrubs than were present in the potential plant community. Livestock grazing should be managed to protect the unit from excessive erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This map unit is in capability subclass VIIe. It is in Saltdesert Breaks range site.

98—Waybe-Vandamore Variant-Rock outcrop complex, 5 to 30 percent slopes. This map unit is on narrow ridgetops and side slopes. Areas are elongated and are 20 to 80 acres. The native vegetation is mainly sparse low shrubs and grasses. Elevation is 7,400 to 8,600 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 45 percent Waybe flaggy clay loam that has slopes of 5 to 30 percent, 25 percent Vandamore Variant channery loam that has slopes of 5 to 15 percent, and 20 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Jerry loam, Owen Creek loam, and Vandamore channery loam. Also included are small areas of soils that are similar to the Waybe and Vandamore Variant soils but are deep and have more or fewer rock fragments. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

The Waybe soil is shallow and well drained. It formed in residuum derived dominantly from clayey shale and interbedded sandstone. Typically, the surface layer is pale brown flaggy clay loam 4 inches thick. The upper 5 inches of the underlying material is light yellowish brown clay, the next 5 inches is light brownish gray channery silty clay loam, and the lower 5 inches is very pale brown channery silty clay loam. Highly weathered platy shale and interbedded sandstone are at a depth of 19 inches. Depth to shale and interbedded sandstone ranges from 10 to 20 inches. In some areas the surface layer is channery clay loam.

Permeability of the Waybe soil is slow. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is moderate to high.

The Vandamore Variant soil is moderately deep and well drained. It formed in residuum derived dominantly from sandstone. Typically, the surface layer is pale brown channery loam about 5 inches thick. The next layer is very pale brown very channery loam about 7 inches thick. The underlying material is very pale brown very channery loam 21 inches thick. Weathered

sandstone is at a depth of about 33 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability of the Vandamore Variant soil is moderate. Available water capacity is moderate to low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate.

Rock outcrop consists of tilted exposures of interbedded sandstone and shale about 1 foot to 10 feet thick. These exposures are on sharp ridge crests. A few small, vertical ledges are on the steeper, lower edges of the unit and are 3 to 15 feet high and 20 to 150 feet long.

Most areas of this unit are used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly bluebunch wheatgrass, bottlebrush squirreltail, Colorado buckwheat, Douglas rabbitbrush, stemless goldenweed, and winterfat. Smaller amounts of streambank wheatgrass, needleandthread, and fringed sagebrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season. Prevailing winds sweep most of the snow cover off the soils in this unit in winter. The average annual production of air-dry vegetation is about 350 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of the shallow depth to rock and areas of Rock outcrop. Livestock grazing should be managed to protect the unit from excessive erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This map unit is in capability subclass VIIe. It is in Dry Exposure range site.

99—Winnemucca-Clayburn loams, 8 to 25 percent slopes. This map unit is on the sides of mountains and uplands and on broad ridges. Areas are irregular in shape and are 400 to 1,000 acres in size. The native vegetation is mainly mountain brush and open areas of low shrubs and grasses. Elevation is 7,600 to 8,800 feet. The average annual precipitation is 18 to 22 inches, the average annual air temperature is 37 to 39 degrees F, and the average frost-free period is 45 to 75 days.

This unit is 60 percent Winnemucca loam that has slopes of 8 to 25 percent and 25 percent Clayburn loam that has slopes of 3 to 15 percent. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cochetopa loam and Irigul and Nagitsy channery loams. Also included are small areas of soils that are similar to the Winnemucca soil but have stones, flagstones, or cobbles on the surface and small areas of Rock outcrop. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Winnemucca soil is deep and well drained. It formed in alluvium and colluvium derived dominantly from sedimentary rock. Typically, the upper part of the surface layer is dark brown loam about 8 inches thick. The lower part is dark brown loam about 8 inches thick. The upper 8 inches of the subsoil is brown cobbly loam, and the lower 8 inches is brown very cobbly clay loam. The next layer is yellowish red very cobbly clay 10 inches thick. The substratum to a depth of 60 inches or more is yellowish red very cobbly clay. In some areas the surface layer is stony loam, fine sandy loam, or light clay loam.

Permeability of the Winnemucca soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high.

The Clayburn soil is deep and well drained. It formed in alluvium and colluvium derived dominantly from shale. Typically, the upper part of the surface layer is very dark grayish brown loam about 4 inches thick. The lower part is dark grayish brown loam about 10 inches thick. The upper 8 inches of the subsoil is dark grayish brown clay loam, and the lower 12 inches is dark grayish brown clay loam. The substratum to a depth of 60 inches or more is grayish brown clay loam. In some areas the surface layer is fine sandy loam or clay loam.

Permeability of the Clayburn soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on the Winnemucca soil is mainly Gambel oak, serviceberry, elk sedge, mountain brome, snowberry, and Letterman needlegrass. Smaller amounts of chokecherry, slender wheatgrass, and American milkvetch commonly are also present in the potential plant community. The production of forage is limited by a short growing season and competition from brush and other plants. The average annual production of air-dry vegetation is about 2,500 pounds per acre.

The potential plant community on the Clayburn soil is mainly Idaho fescue, Letterman needlegrass, slender wheatgrass, mountain brome, big sagebrush, and snowberry. Smaller amounts of serviceberry, low rabbitbrush, and lupine commonly are also present in the potential plant community. The production of forage is limited by a short growing season and competition from

brush and other plants. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Brush management and reseeding are also suitable practices where slopes are less than 15 percent. The main limitations for seeding are a short growing season and difficulty of removing brush. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This unit is used extensively as summer and winter range for mule deer and elk.

This map unit is in capability subclass VIIe, nonirrigated. The Winnemucca soil is in Brushy Loam range site, and the Clayburn soil is in Mountain Loam range site.

100—Work loam, 1 to 3 percent slopes. This deep, well drained soil is on uplands, fans, and terraces. It formed in eolian and alluvial material. Areas are elongated and are 20 to 200 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 6,100 to 7,400 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is brown loam 10 inches thick. The upper 5 inches of the subsoil is brown clay loam, and the lower 10 inches is light brown clay loam. The next layer is light brown clay loam 5 inches thick. The upper 20 inches of the substratum is pink clay loam, and the lower part to a depth of 60 inches or more is pink loam. In some areas below a depth of 30 inches, this soil is as much as 25 percent rock fragments. In some areas the surface layer is fine sandy loam or clay loam.

Included in this unit are small areas of Forelle loam, Guben loam, Shawa loam, Silas Variant soils, and Zoltay clay loam. Also included are small areas of soils that are wet as a result of irrigation in higher lying areas. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Work soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

This unit is used mainly as irrigated and nonirrigated cropland. It is also used for livestock grazing and wildlife habitat and as homesites. Hay and pasture are the main irrigated crops, and wheat is the main nonirrigated crop.

This unit is well suited to hay and pasture. It has few limitations. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leveling helps to insure the uniform application of water. Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus.

Grazing when the soil in this unit is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This unit is well suited to nonirrigated small grain. It is limited mainly by a short growing season and low precipitation in summer. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Compaction and excessive cloddiness occur if the soil in this unit is cultivated when it is too moist. Tillage should be kept to a minimum. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Maintaining crop residue on or near the surface also reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass.

Drainage is beneficial in the small, included areas of wet soils. Tile drainage can be used to lower the water table if a suitable outlet is available.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, big sagebrush, muttongrass, bluebunch wheatgrass, and low rabbitbrush. Smaller amounts of serviceberry and snowberry commonly are also present in the potential plant community. The production of forage is limited by a short growing season and low precipitation in summer. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the

soil in the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If the range vegetation is seriously deteriorated, seeding is needed. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for homesite development, the main limitations are the potential for shrinking and swelling and slow permeability. Structures to divert runoff are needed if buildings and roads are constructed. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling excavations with material that has low shrink-swell potential.

This map unit is in capability subclass IVc. It is in Deep Loam range site.

101—Work loam, 3 to 8 percent slopes. This deep, well drained soil is on uplands, fans, and terraces. It formed in eolian and alluvial material. Areas are elongated and are 20 to 400 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 6,100 to 7,400 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is brown loam 10 inches thick. The upper 5 inches of the subsoil is brown clay loam, and the lower 10 inches is light brown clay loam. The next layer is light brown clay loam 5 inches thick. The upper 20 inches of the substratum is pink clay loam, and the lower part to a depth of 60 inches or more is pink loam. In some areas below a depth of 30 inches, this soil is as much as 25 percent rock fragments. In some areas the surface layer is fine sandy loam or clay loam.

Included in this unit are small areas of Forelle, Guben, and Shawa loams, Silas Variant soils, and Zoltay clay loam. Also included are small areas of soils that are wet as a result of irrigation in higher lying areas. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Work soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used mainly as irrigated and nonirrigated cropland. It is also used for livestock grazing and wildlife habitat and as homesites. Hay and pasture are the main irrigated crops, and wheat is the main nonirrigated crop.

This unit is well suited to hay and pasture. It has few limitations. For good establishment of hay and pasture, prepare a seedbed, drill in the seed, and use supplemental irrigation. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leveling helps to insure the uniform application of water. Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus.

Grazing when the soil in this unit is wet results in compaction of the surface layer, poor tilth, and excessive runoff. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

This unit is well suited to nonirrigated small grain crops. It is limited mainly by a short growing season, low precipitation in summer, and a moderate hazard of water erosion from snowmelt. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Compaction and excessive cloddiness occur if the soil in this unit is cultivated when it is too moist. Tillage should be kept to a minimum. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Maintaining crop residue on or near the surface also reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass.

Drainage is beneficial in the small, included areas of wet soils. Tile drainage can be used to lower the water table if a suitable outlet is available.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, big sagebrush, muttongrass, bluebunch wheatgrass, and low rabbitbrush. Smaller amounts of serviceberry and snowberry commonly are also present in the potential plant community. The production of forage is limited by a short growing season and low precipitation in summer. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If the range vegetation is seriously deteriorated, seeding is needed. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for

seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for homesite development, the main limitations are the potential for shrinking and swelling and slow permeability. Structures to divert runoff are needed if buildings and roads are constructed. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling with material that has low shrink-swell potential.

This map unit is in capability subclass IVe. It is in Deep Loam range site.

102—Work loam, 8 to 15 percent slopes. This deep, well drained soil is on uplands, fans, and terraces. It formed in eolian and alluvial material. Areas are elongated and are 20 to 300 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 6,100 to 7,400 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the upper part of the surface layer is brown loam about 4 inches thick. The lower part is brown loam about 6 inches thick. The upper 5 inches of the subsoil is brown clay loam, and the lower 10 inches is light brown clay loam. The next layer is light brown clay loam 15 inches thick. The upper 20 inches of the substratum is pink clay loam, and the lower part to a depth of 60 inches or more is pink loam. In some areas below a depth of 30 inches, this soil is as much as 25 percent rock fragments. In some areas the surface layer is fine sandy loam or clay loam.

Included in this unit are small areas of Forelle, Guben, and Shawa loams and Zoltay clay loam. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Work soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high.

This unit is used as nonirrigated cropland and for livestock grazing and wildlife habitat. Wheat is the main nonirrigated crop.

If this unit is used for nonirrigated crops, the main limitations are a short growing season, low precipitation in summer, slope, and the hazard of water erosion from snowmelt. The steeper areas are poorly suited to cultivation.

Compaction and excessive cloddiness occur if the soil in this unit is cultivated when it is too moist. Tillage should be kept to a minimum. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Maintaining crop residue on or near the surface also reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content, to conserve moisture, and to reduce erosion. Erosion also is reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, big sagebrush, muttongrass, bluebunch wheatgrass, and low rabbitbrush. Smaller amounts of serviceberry and snowberry commonly are also present in the potential plant community. The production of forage is limited by a short growing season and low precipitation in summer. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If the range vegetation is seriously deteriorated, seeding is needed. The main limitations for seeding are low precipitation in summer and slow permeability. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass IVe, nonirrigated. It is in Deep Loam range site.

103—Work loam, 15 to 25 percent slopes. This deep, well drained soil is on uplands. It formed in eolian and alluvial material. Areas are irregular in shape and are 20 to 200 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 6,600 to 7,600 feet. The average annual precipitation is 16 to 20 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 75 to 100 days.

Typically, the surface layer is grayish brown loam 4 inches thick. The upper 10 inches of the subsoil is grayish brown clay loam, and the lower 11 inches is brown clay. The next layer is pale brown clay loam 15 inches thick. The substratum to a depth of 60 inches or more is pale brown clay loam. In some areas the surface layer is clay loam or silty clay loam.

Included in this unit are small areas of Abor, Bulkley, Pinelli, and Zoltay clay loams. Also included are small areas of soils that are similar to this Work soil but are moderately deep to bedrock. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Work soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high. The hazard of erosion from snowmelt is high in areas where the surface is unprotected or the native cover is disturbed.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly needleandthread, western wheatgrass, big sagebrush, muttongrass, bluebunch wheatgrass, and low rabbitbrush. Smaller amounts of serviceberry and snowberry commonly are also present in the potential plant community. The production of forage is limited by a short growing season and slow permeability. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of steepness of slope, slow permeability, the hazard of erosion, and difficulty of brush removal. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Livestock grazing should be managed to protect the soil from excessive erosion.

This unit is used extensively as winter range for mule deer and elk.

This map unit is in capability subclass VIe, nonirrigated. It is in Deep Loam range site.

104—Yamac loam, 2 to 15 percent slopes. This deep, well drained soil is on rolling uplands, terraces, and fans. It formed in eolian and alluvial material. Areas are elongated and are 20 to 500 acres. The native vegetation is mainly low shrubs and grasses. Elevation is 5,800 to 7,100 feet. The average annual precipitation is 13 to 16 inches, the average annual air temperature is 40 to 45 degrees F, and the average frost-free period is 80 to 105 days.

Typically, the surface layer is brown loam 4 inches thick. The upper 8 inches of the subsoil is brown loam, and the lower 10 inches is highly calcareous loam. The upper 26 inches of the substratum is very pale brown loam, and the lower part to a depth of 60 inches or more is pale brown loam.

Included in this unit are small areas of Forelle loam, Piceance fine sandy loam, Redcreek sandy loam, and Rentsac channery loam. Also included are small areas of strongly alkaline slickspots that are less than 50 feet in diameter and small areas of soils that are subject to gullying. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Yamac soil is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to moderate.

Most areas of this unit are used for livestock grazing and wildlife habitat. The unit is used extensively as winter range for mule deer. A few areas are used for nonirrigated small grain.

The potential plant community on this unit is mainly big sagebrush, western wheatgrass, streambank wheatgrass, prairie junegrass, Douglas rabbitbrush, and winterfat. Smaller amounts of needleandthread and sedges commonly are also present in the potential plant community. The average annual production of air-dry vegetation is about 800 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in the unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

If the range vegetation is seriously deteriorated, seeding is needed. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for nonirrigated crops, the main limitations are low precipitation in summer and the hazard of erosion on the steeper slopes. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content, to conserve moisture, and to reduce erosion. Erosion also is reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass.

This map unit is in capability subclass IVe, nonirrigated. It is in Rolling Loam range site.

105—Zoltay clay loam, 1 to 3 percent slopes. This deep, well drained soil is on fans and terraces. It formed in alluvium derived dominantly from sedimentary rock. Areas are irregular in shape and are 20 to 50 acres in size. The native vegetation is mainly low shrubs and

grasses. Elevation is 6,000 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is dark grayish brown light clay loam 8 inches thick. The upper 5 inches of the subsoil is very dark grayish brown clay loam, the next 9 inches is brown cobbly clay loam, and the lower 9 inches is pale brown cobbly clay loam. The upper 9 inches of the substratum is very pale brown cobbly clay loam, and the lower part to a depth of 60 inches or more is very pale brown cobbly loam. In some areas the surface layer is loam or cobbly loam.

Included in this unit are small areas of Forelle, Guben, and Work loams. Also included are small areas of soils that are similar to this Zoltay soil but are cobbly throughout. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Zoltay soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight.

Most areas of this unit are used as irrigated and nonirrigated cropland. Hay and pasture are the main irrigated crops, and wheat is the main nonirrigated crop. A few areas are used for livestock grazing and wildlife habitat.

This unit is well suited to irrigated hay and pasture. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the unit. Leveling helps to insure the uniform application of water. Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage.

This unit is well suited to nonirrigated small grain crops. It is limited mainly by a short growing season and low precipitation in summer. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Compaction and excessive cloddiness occur if the soil in this unit is cultivated when it is too moist. Tillage should be kept to a minimum. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Maintaining crop residue on or near the surface also reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content.

The potential plant community on this unit is mainly Columbia needlegrass, western wheatgrass, big sagebrush, muttongrass, serviceberry, and snowberry. Smaller amounts of bluebunch wheatgrass, needleandthread, and low rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season, low precipitation in summer, and moderately slow permeability. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for urban development, the main limitations are the potential for shrinking and swelling and slow permeability.

This map unit is in capability subclass IVc. It is in Deep Loam range site.

106—Zoltay clay loam, 3 to 8 percent slopes. This deep, well drained soil is on fans and terraces. It formed in alluvium derived dominantly from sedimentary rock. Areas are irregular in shape and are 20 to 500 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 6,000 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is dark grayish brown light clay loam 8 inches thick. The upper part of the subsoil is very dark grayish brown clay loam 5 inches thick, the next 9 inches is brown cobbly clay loam, and the lower 9 inches is pale brown cobbly clay loam. The upper 9 inches of the substratum is very pale brown cobbly clay loam, and the lower part to a depth of 60 inches or more is very pale brown cobbly loam. In some areas the surface layer is loam or cobbly loam.

Included in this unit are small areas of Forelle, Guben, and Work loams. Also included are small areas of soils that are similar to this Zoltay soil but are cobbly throughout. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Zoltay soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to moderate.

Most areas of this unit are used as irrigated and nonirrigated cropland. Hay and pasture are the main irrigated crops, and wheat is the main nonirrigated crop. A few areas are used for livestock grazing and wildlife habitat.

This unit is well suited to irrigated hay and pasture. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Leveling helps to insure the uniform application of water. Nonleguminous crops respond to nitrogen and phosphorus, and leguminous crops respond to phosphorus.

Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Proper grazing practices, weed control, and fertilizer are needed to insure maximum quality of forage.

This unit is well suited to nonirrigated small grain crops. It is limited mainly by a short growing season and low precipitation in summer. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable.

Compaction and excessive cloddiness occur if the soil in this unit is cultivated when it is too moist. Tillage should be kept to a minimum. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Maintaining crop residue on or near the surface also reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Erosion can be reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or across the slope. Also, waterways should be shaped and seeded to perennial grass.

The potential plant community on this unit is mainly Columbia needlegrass, western wheatgrass, big sagebrush, muttongrass, serviceberry, and snowberry. Smaller amounts of bluebunch wheatgrass, needleandthread, and low rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season, low precipitation in summer, and moderately slow permeability. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If this unit is used for urban development, the main limitations are the potential for shrinking and swelling and slow permeability.

This map unit is in capability subclass IVc. It is in Deep Loam range site.

107—Zoltay clay loam, 8 to 15 percent slopes. This deep, well drained soil is on fans and terraces. It formed in alluvium derived dominantly from sedimentary rock. Areas are irregular in shape and are 20 to 500 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 6,000 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 85 to 105 days.

Typically, the surface layer is dark grayish brown clay loam 8 inches thick. The upper 5 inches of the subsoil is very dark grayish brown clay loam, and the lower 9 inches is brown cobbly clay loam. The next layer is pale brown cobbly clay loam 9 inches thick. The upper 9 inches of the substratum is very pale brown cobbly clay loam, and the lower part to a depth of 60 inches or more is very pale brown cobbly loam. In some areas the surface layer is loam or cobbly loam.

Included in this unit are small areas of Forelle, Guben, and Work loams. Also included are small areas of soils that are similar to this Zoltay soil but are cobbly throughout. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Zoltay soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high.

This unit is used as irrigated and nonirrigated cropland and for livestock grazing and wildlife habitat. Wheat is the main nonirrigated crop.

If this unit is used for nonirrigated small grain crops, the main limitations are a short growing season, low precipitation in summer, and the hazard of erosion. The steeper slopes are poorly suited to cultivation.

Compaction and excessive cloddiness occur if the soil in this unit is cultivated when it is too moist. Tillage should be kept to a minimum. Returning crop residue to the soil or regularly adding other organic matter improves fertility, reduces crusting, and increases the water intake rate. Maintaining crop residue on or near the surface also reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Erosion is reduced if fall grain is seeded early, stubble-mulch tillage is used, and tillage and seeding are on the contour or

across the slope. Also, waterways should be shaped and seeded to perennial grass.

The potential plant community on this unit is mainly Columbia needlegrass, western wheatgrass, big sagebrush, muttongrass, serviceberry, and snowberry. Smaller amounts of bluebunch wheatgrass, needleandthread, and low rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season, low precipitation in summer, and moderately slow permeability. The average annual production of air-dry vegetation is about 1,500 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure.

Range seeding is also suitable if the range is in poor condition. For successful seeding, prepare a seedbed and drill in the seed. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

This map unit is in capability subclass IVe. It is in Deep Loam range site.

108—Zoltay clay loam, 15 to 25 percent slopes. This deep, well drained soil is on the edges of terraces and on valley sides. It formed in alluvium derived dominantly from sedimentary rock. Areas are irregular in shape and are 20 to 300 acres in size. The native vegetation is mainly low shrubs and grasses. Elevation is 6,000 to 7,200 feet. The average annual precipitation is 15 to 18 inches, the average annual air temperature is 39 to 42 degrees F, and the average frost-free period is 75 to 100 days.

Typically, the surface layer is dark grayish brown clay loam 4 inches thick. The upper 5 inches of the subsoil is very dark grayish brown clay loam, and the lower 9 inches is brown cobbly clay loam. The next layer is pale brown cobbly clay loam 9 inches thick. The upper 9 inches of the substratum is very pale brown cobbly clay loam, and the lower part to a depth of 60 inches or more is very pale brown cobbly loam. In some areas the surface layer is loam or cobbly loam.

Included in this unit are small areas of Dollard silty clay loam, Guben loam, Forelle loam, Mergel channery loam, and Work loam. Also included are small areas of soils that are similar to this Zoltay soil but are moderately deep to shale. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Zoltay soil is moderately slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high.

This unit is used for livestock grazing and wildlife habitat.

The potential plant community on this unit is mainly Columbia needlegrass, western wheatgrass, big sagebrush, muttongrass, serviceberry, and snowberry. Smaller amounts of bluebunch wheatgrass, needleandthread, Indian ricegrass, and low rabbitbrush commonly are also present in the potential plant community. The production of forage is limited by a short growing season, low precipitation in summer, and rapid runoff. The average annual production of air-dry vegetation is about 1,200 pounds per acre.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices suitable for use on this unit are proper range use, deferred grazing, rotation grazing, and brush management. Seeding is not advisable because of steepness of slope, slow permeability, the hazard of erosion, and difficulty of brush removal. Grazing should be delayed until the soil in this unit is firm and the more desirable forage plants have achieved sufficient growth to withstand grazing pressure. Livestock grazing should be managed to protect the soil from excessive erosion.

This unit is used extensively as winter range for mule deer and elk.

This map unit is in capability subclass VIe, nonirrigated. It is in Deep Loam range site.

prime farmland

Prime farmland, as defined by the United States Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It must either be used for producing food or fiber or be available for these uses. When managed properly, it has the soil quality, length of growing season, and moisture supply needed to economically produce a sustained high yield of crops. Prime farmland produces the highest yields with minimal energy and economic resources, and farming it results in the least disturbance of the environment.

Prime farmland commonly has an adequate and dependable supply of moisture from precipitation or irrigation. It also has a favorable temperature and length of growing season and an acceptable level of acidity or alkalinity. It has few if any rock fragments and is permeable to water and air. Prime farmland is not

excessively eroded or saturated with water for long periods and is not flooded during the growing season. The slope is not more than 6 percent. Soils that are limited by a high water table, a hazard of flooding, or low precipitation may qualify for prime farmland if the limitation can be overcome by practices such as drainage, flood control, or irrigation.

About 16,600 acres, or less than 1 percent, of the survey area meets the requirements for prime farmland. This acreage must be irrigated to qualify as prime farmland. It is mainly along major streams. Nearly all of the acreage is irrigated hayland.

Areas of the following map units that have slopes of 6 percent or less meet the soil requirements for prime farmland when irrigated. The units that are identified by an asterisk have exceptionally high potential for prime farmland. This list does not constitute a recommendation for a particular land use.

7—Billings silty clay loam, 0 to 5 percent slopes
25—Colorow sandy loam
33—Forelle loam, 3 to 8 percent slopes
36—Glendive fine sandy loam*
37—Glenton sandy loam, 1 to 6 percent slopes*
41—Havre loam, 0 to 4 percent slopes
46—Kinnear fine sandy loam, 1 to 5 percent slopes
47—Kobar silty clay loam, 0 to 3 percent slopes
48—Kobar silty clay loam, 3 to 8 percent slopes
60—Patent loam, 0 to 3 percent slopes
61—Patent loam, 3 to 8 percent slopes
66—Potts-Begay fine sandy loams, 2 to 7 percent slopes*
79—Shawa loam, 1 to 3 percent slopes
80—Shawa loam, 3 to 8 percent slopes
81—Shawa loam, wet, 0 to 5 percent slopes
84—Silas Variant loam
92—Trembles loam, wet
93—Turley fine sandy loam, 0 to 3 percent slopes
94—Turley fine sandy loam, 3 to 8 percent slopes
100—Work loam, 1 to 3 percent slopes
101—Work loam, 3 to 8 percent slopes
105—Zoltay clay loam, 1 to 3 percent slopes
106—Zoltay clay loam, 3 to 8 percent slopes

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, large stones, or wetness can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Alvin Jones, district conservationist, Soil Conservation Service, helped to write this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; prime farmland is defined, and the map units are listed that qualify for prime farmland if irrigated; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About 65 percent of the survey area is used for crops and pasture. Of this, about 67,750 acres is irrigated and about 27,100 acres is nonirrigated.

Management needs for maintaining production and for controlling soil blowing and water erosion vary widely throughout the area because of the diversity of farming methods. Soil erosion is a major management consideration for all the soils in the area; however, the highest hazard of erosion is in areas of irrigated cropland that has slopes of more than 3 percent and in areas of nonirrigated cropland. Production is substantially reduced in areas where the surface layer has been subject to soil blowing or water erosion, or both.

Using irrigation water efficiently and distributing it uniformly, protecting the soil from erosion, and maintaining soil fertility are the main management aims on the irrigated soils. The length of runs, the width of slopes, the amount and duration of flow, and the frequency of irrigation should all be considered. Land leveling is needed on most soils in the area to permit more uniform distribution of water and to reduce runoff and erosion.

Border and furrow irrigation methods are suited to the soils that have slopes of 0 to 3 percent. The soils that have slopes of 3 to 8 percent are suited to furrow and ditch methods of irrigation if furrows and ditches are placed on the contour. Sprinkler irrigation systems are suited to all cultivated soils. Use of crop residue improves the organic matter content, soil tilth, and the water intake rate of the soils. Applications of manure and commercial fertilizer containing nitrogen and phosphorus are very important in maintaining the fertility of all the irrigated soils.

The hazard of soil blowing is slight in most areas of nonirrigated cropland; the hazard of water erosion is higher mainly because of snowmelt in spring. The risk of erosion can be reduced by leaving adequate quantities of crop residue on the surface and by growing cover

crops. The risk of erosion from snowmelt can be reduced by stubble-mulch tillage, contour stripcropping, and contour tillage.

Drainage is a concern on some soils used for irrigated crops and pasture. Soils on the low terraces of the White River and Piceance Creek, such as Redrob; Shawa, wet; and Hagga soils, have a fluctuating water table that cannot be readily lowered because of a lack of outlets. These soils can be used as cropland without drainage by choosing adapted crops and by maintaining the water table at a constant level by careful control of irrigation water. Soils affected by wetness as a result of seepage from irrigation canals in upland areas may be reclaimed by use of open and tile drains or by lining canals. Examples of these soils are small localized areas of Work loam and Zoltay clay loam that are underlain by intermittent coarse glacial deposits. A combination of surface and subsurface drains commonly is needed for intensive cropping. Tile drains and open *V*-shaped drainage ditches are effective in minimizing wetness in seep areas. Drainage of these areas generally is accomplished by installing interceptor drains.

Management practices suitable for irrigated pasture consisting of alfalfa and warm- and cool-season grasses, include deferring grazing until the plants have become established and have attained a suitable height and maintaining adequate cover to insure protection from erosion. Timely application of irrigation water is also important. Establishing irrigated pasture or hay in sloping areas of irrigated cropland minimizes the hazards of soil blowing and water erosion. Management practices such as controlled grazing, cross-fencing, and proper distribution of stock watering facilities and salt help to maintain production of irrigated pasture.

The amount of rainfall is important to management of nonirrigated soils. Wheat is the principal nonirrigated crop in the area. Yields are highest in the eastern part of the area that receives 16 to 19 inches of precipitation annually. The effectiveness of commercial fertilizer is limited by the low precipitation.

Controlling soil blowing and water erosion and conserving soil moisture are the major management concerns in areas of nonirrigated cropland. Because of limited precipitation, a crop-fallow system is most suitable. Stubble-mulching and adding crop residue to the soil protect fallowed soils from soil blowing and water erosion and allow them to readily absorb and retain moisture. Sweeps, blades, chisels, or rod weeders generally are used for tillage.

Loamy soils in the more sloping areas are susceptible to water erosion because of surface runoff, especially during high-intensity storms or rapid snowmelt. Use of stripcropping and contour cultivation help to control water erosion and to conserve moisture (fig. 7). Tillage should be kept to a minimum to prevent soil compaction. Chiseling and subsoiling help to break up the plowpan and the compacted subsoil, which improves the water intake rate. Diversions commonly are needed to prevent water from adjacent areas of rangeland from running onto cultivated fields.

Moderately eroded to severely eroded areas of nonirrigated cropland are best suited to permanent pasture. Seeding a cover crop in a well prepared seedbed may be needed before forage grasses can be established. Grazing should be deferred until the grasses are well established. Controlled grazing is needed to maintain stands. On eroded soils, growing grasses helps to control erosion and generally is more profitable than growing other crops.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the

way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e*

Figure 7.—Area northeast of Meeker showing stripcropping, contour farming, stubble mulching, summer fallow, and erosion control dams.

shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

By Harmon S. Hodgkinson, range conservationist, Soil Conservation Service.

About 85 percent of the survey area is rangeland. More than two-thirds of the farm income is derived from livestock. Cow-calf and ewe-lamb are the principal ranch operations.

The average ranch in the area consists of 2,900 acres of privately owned land in addition to land leased from the Forest Service and Bureau of Land Management. Many ranches have some woodland, and nearly all have some irrigated land.

Livestock graze on the privately owned areas of rangeland and woodland during spring and fall. Areas of the land leased from the Forest Service and Bureau of Land Management that are at high elevations are grazed in summer. The areas of land administered by the Bureau of Land Management that are at low elevations are grazed in winter, primarily by sheep. The aftermath of hay and small grain crops on irrigated land is grazed late in fall. During winter livestock are fed hay.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

For each soil in the survey area that is suited to use as rangeland, the range site, the average annual production of vegetation, and the characteristic vegetation are given in the section "Detailed soil map units." Range site descriptions can be obtained from the local office of the Soil Conservation Service.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

The average annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation.

The characteristic vegetation is the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil. It is listed by common name. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Several conservation practices are suitable for use on rangeland in the survey area. These include proper grazing use, a planned grazing system, seeding, and brush management. Proper grazing use is grazing at an intensity that will maintain enough cover to protect the soil and maintain or improve the quality and quantity of desirable vegetation. This is achieved when at least 50 percent of the annual production, by weight, remains at the end of the grazing season. When proper grazing alone will not maintain or accelerate improvement in vegetation, a planned grazing system will help. In a planned grazing system, two or more grazing units are alternately rested from grazing in a planned sequence over a period of years. The rest period can be throughout the year or during the growing season of the key plants. This grazing system will improve efficiency of grazing through uniform use of all grazing units. Distribution of livestock in areas of rangeland can be

achieved by fencing, developing watering facilities, and properly locating salt.

If undesirable shrubs have become dominant in the plant community and are competing with forage plants, brush management should be used. Caution should be exercised when manipulating or reducing brush so that critical winter range for wildlife is not destroyed; the adequate cover is retained in areas where slopes are too steep, thus avoiding accelerated soil erosion; and enough grass is available to fill in the voids left by removal of the brush. If the rangeland is severely deteriorated, seeding commonly is the most economical and fastest method of revegetation. Soils that are too steep, shallow, or rocky generally are not suited to seeding.

woodland management and productivity

Woodland is throughout the area but is chiefly in general map units 6, 8, 9, and 12. The form, shape, and growth rate of the trees in much of the woodland are such that management for producing wood crops is not economically feasible.

Some fairly good commercial timber grows on the Cowdrey soils in general map unit 12, in the eastern part of the survey area. These areas are small, and they commonly extend outside of the survey area into national forest land. In other parts of general map unit 12, aspen gradually is being replaced by conifers; however, aspen will remain the dominant species for many years. Much of the aspen is noncommercial timber, but some has good potential for producing wood crops. Areas in which aspen is the dominant species provide good to excellent grazing in summer.

Cottonwood trees border the White River in the eastern half of the survey area. They provide perching sites for bald eagle and other birds. They also add to the scenic value of the area and are a good source of firewood.

The trees in the woodland areas protect the soils from erosion and provide valuable food and cover for wildlife, and the understory provides grazing for sheep and cattle, which are important to the economy of the area. The woodland is also important as recreational sites and is valuable as watershed. The area is notable for its hunting, fishing, and recreational opportunities.

Pinyon and juniper woodland makes up about 78 percent of the survey area. Most of it is in general map units 6, 8, and 9. A minor acreage of smaller juniper trees is in general map unit 5. Elevation in areas of this woodland type ranges from 5,200 to 7,800 feet. Pinyon generally is dominant in the moister areas, and juniper in the drier areas. This woodland is used mainly for firewood, fenceposts, and Christmas trees. Wildlife use the woodland for cover and food.

Aspen woodland makes up about 2 percent of the area. It is mainly on the Lamphier, Kamack, Tampico, and Northwater soils. Generally it is on steep side slopes and narrow valley bottoms in the eastern part of the area. Elevation is 7,200 to 9,400 feet. Smaller areas of nearly pure stands of aspen are near the Garfield County line in the south-central part of the area. The aspen woodland is used mainly for summer grazing and wildlife habitat.

Lodgepole pine and spruce-fir woodland types make up less than 1 percent of the survey area. They are mostly on the Cowdrey soils. These woodland types are dominated by lodgepole pine, Engelmann spruce, and subalpine fir with some aspen. They are on mountainsides in the eastern part of the area. Elevation is 7,800 to 9,000 feet. Lodgepole pine is used for poles, and Engelmann spruce is used mostly for sawtimber.

woodland understory vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

For each soil in the survey area used as woodland, the major understory plants and the air-dry weight of usable forage are given in the section "Detailed soil map units." These plants can be expected to grow in a well-managed, open area of woodland.

Some areas of pinyon and juniper woodland may need thinning for the potential understory vegetation to be achieved. Where slope or the amount of stones is not excessive, production of understory vegetation can be increased by chaining, bulldozing trees into ricks, burning the ricks, and then drilling in seed using a mixture of plant species adapted to the area (fig. 8). Strips of trees provide a good combination of open areas and cover for wildlife habitat. The local office of the Soil Conservation Service or Forest Service can provide technical assistance in chaining.

recreation

Hunting and fishing are the main outdoor recreational activities in the survey area. Backpacking, cross-country skiing, and snowmobiling are increasing in popularity. Overnight camping is available near the major streams and lakes in the area. During fall, the area provides scenic value for photographers and many others.

Hunting of big game animals such as elk, deer, bear, antelope, and mountain lion is an important recreational use of the area during much of the year. However, the

number of elk, bear, antelope, and mountain lion is limited, which restricts the number of hunters. Mule deer, on the other hand, are numerous.

Fishing is largely done in the White River and its main tributaries, which offer good fishing for trout in spring, in summer, and early in fall and for whitefish in winter. The part of the White River below its confluence with Piceance Creek is too warm for trout but provides good fishing for catfish.

There are two reservoirs in the area. The larger and most used is Lake Avery, about 2 miles west of Buford. This lake offers very good trout fishing. The other is Rio Blanco Lake, about 17 miles west of the town of Meeker. This is a shallow lake and has warmer water. It is stocked with northern pike, crappie, and catfish. Both of these lakes have good camping areas.

The survey area also has several resort lodges. These lodges provide many outdoor activities such as hunting, fishing, horseback riding, backpacking, and overnite camping. Most of the lodges provide cabins and restaurants.

wildlife habitat

By Eldie W. Mustard Jr., biologist, Soil Conservation Service.

Each species of wildlife has individual requirements for food, cover, and water. A soil in its natural state may provide one or more of these needs, and practices such as planting suitable plant species, increasing or maintaining the number of desirable plants, developing water sources, and improving the availability of water can be used to improve wildlife habitat.

Wildlife in the survey area is a valuable resource. The game species common to the survey area are elk, mule deer, pronghorn antelope, black bear, two species of cottontail rabbit, snowshoe hare, white-tailed jackrabbit, ring-necked pheasant, blue grouse, sage grouse, Canada goose, and several species of duck. Important predators include mountain lion, bobcat, badger, coyote, gray fox, red fox, striped skunk, marten, mink, weasels, raccoon, owls, eagles, hawks, prairie rattlesnake and several other species of snake, and prairie lizards. Some wild horses usually are in the area extending from the Piceance Creek Basin westward to the Utah state line.

Figure 8.—Area of pinyon and juniper woodland that has been chained to increase production of understory vegetation.

The White River and its tributaries contain a variety of fish, including Rocky Mountain whitefish, rainbow trout, brook trout, brown trout, and native cutthroat trout.

Many nongame species of wildlife are also in the survey area. Among these are several species of hummingbird, many native songbirds, raven, magpie, turkey buzzard, montane vole, Utah tiger salamander, and roundtail chub. Rodents, including beaver, muckrat, yellow-bellied marmot, porcupine, white-tailed prairie dog, ground squirrels, chipmunks, and mice, are abundant throughout the area.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 6, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, crested wheatgrass, orchardgrass, bromegrass, yellow clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are Indian ricegrass, sunflower, lupine, western wheatgrass, and saline wildrye.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pinyon, blue spruce, Douglas-fir, Utah juniper, and Rocky Mountain juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, rabbitbrush, winterfat, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are cattail, wild millet, wildrice, saltgrass, reed canarygrass, rushes, and sedges.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, deer, and bear.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sage grouse, meadowlark, and lark bunting.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 7 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, septic tank absorption fields, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to

sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

water management

Table 8 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding, and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design

and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect their maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 9 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 10 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For some soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application, and by the smoothness of the surface. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for some soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 10, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 11 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt and water in old oxbows are not considered flooding.

Table 11 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; May-July, for example, means that flooding can occur during the period May through July.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than

that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 11 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 11.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*13*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 12, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Fluvaquents (*Fluv*, meaning stratified horizonation, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Fluvaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed (calcareous), frigid Typic Fluvaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*12*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*13*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Abor series

The Abor series consists of moderately deep, well drained, undulating to hilly soils on foothills, toe slopes, and uplands. These soils formed in residuum derived from clayey shale. Slope is 5 to 30 percent. Average annual precipitation is about 15 inches, and average annual air temperature is about 43 degrees F.

These soils are fine, montmorillonitic, frigid Udorthentic Chromusterts.

Typical pedon of Abor clay loam, 5 to 30 percent slopes, in the NW1/4SE1/4 of sec. 20, T. 3 N., R. 91 W.

A1—0 to 4 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; 5 percent fine channery fragments; calcareous; moderately alkaline; clear smooth boundary.

B21—4 to 12 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm, sticky and plastic; 5 percent fine channery fragments; calcareous; moderately alkaline; gradual smooth boundary.

B22—12 to 18 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; common pressure faces on peds; common vertical cracks more than 1/2 inch wide; very hard, firm, sticky and plastic; 5 percent fine channery fragments and shale chips; calcareous; strongly alkaline; gradual wavy boundary.

B3ca—18 to 24 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; very hard, firm, sticky and plastic; common fine highly weathered shale chips; common visible fine threads and seams of calcium carbonate; calcareous; gradual wavy boundary.

C1—24 to 28 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, firm, sticky and plastic; 60 percent fine weathered chips of shale; weakly calcareous; clear wavy boundary.

Cr—28 inches; gray platy shale.

Depth to shale ranges from 20 to 40 inches. When the soils are dry, cracks 1/2 inch to 2 inches wide extend to a depth of 20 inches or more. The profile is moderately alkaline or strongly alkaline. It has hue of 10YR to 2.5Y, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 or 3. The control section is clay to silty clay and is 40 to 55 percent clay.

Absarokee series

The Absarokee series consists of moderately deep, well drained soils on mountainsides. These soils formed in residuum and colluvium derived from shale and sandstone. Slope is 8 to 65 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 40 degrees F.

These soils are fine, montmorillonitic Typic Argiborolls.

Typical pedon of an Absarokee channery loam in an area of Absarokee-Delson channery loams, 8 to 65 percent slopes, in the SW1/4SE1/4 of sec. 6, T. 1 S., R. 92 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; soft, very friable; 20 percent sandstone and shale channery fragments that generally are less than 3 inches in diameter; neutral; clear wavy boundary.

B21t—4 to 11 inches; brown (7.5YR 5/2) channery clay loam, dark brown (7.5YR 3/2) moist; moderate to strong fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; few thin clay films on ped faces; 20 percent channery fragments that generally are less than 3 inches in diameter; neutral; clear wavy boundary.

B22t—11 to 22 inches; brown (10YR 5/3) channery heavy clay loam, dark grayish brown (10YR 4/2) moist; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; common thin clay films on ped faces; 30 percent channery fragments that generally are less than 6 inches in diameter; neutral; clear wavy boundary.

Cr2—22 to 26 inches; fractured weathered bedrock with some soil material in the fractures; abrupt smooth boundary.

R—26 inches; hard shale and sandstone.

Depth to bedrock ranges from 20 to 40 inches. Some cracks less than 1/2 inch wide and less than 20 inches deep may develop during prolonged dry periods. The B horizon is brown to dark brown channery clay loam or clay. The lower part of the B horizon is slightly calcareous in some pedons.

Absher series

The Absher series consists of deep, well drained soils on alluvial valley floors, fans, and terraces. These soils formed in mixed recent alluvium derived from shale. Slope is 0 to 8 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 43 degrees F.

These soils are fine, montmorillonitic Borollic Natrargids.

Typical pedon of Absher loam, 0 to 3 percent slopes, 1,550 feet east and 900 feet south of the northwest corner of sec. 21, T. 3 S., R. 94 W.

A2—0 to 3 inches; very pale brown (10YR 7/3) loam, brown (7.5YR 4/2) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; mildly alkaline; abrupt wavy boundary.

B21t—3 to 8 inches; brown (7.5YR 5/2) silty clay, brown (7.5YR 4/2) moist; strong coarse columnar structure parting to strong medium angular blocky; very hard, firm, sticky and plastic; moderately alkaline; abrupt wavy boundary.

B22t—8 to 13 inches; pinkish gray (7.5YR 6/2) silty clay, brown (7.5YR 4/2) moist; moderate coarse angular

blocky structure; extremely hard, firm, very sticky and plastic; moderately alkaline; clear wavy boundary.

B3ca—13 to 23 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/5) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; few fine seams and soft masses of lime; calcareous; strongly alkaline; gradual wavy boundary.

C1cacs—23 to 44 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 4/3) moist; massive; very hard, friable, slightly sticky and slightly plastic; few fine seams and soft masses of gypsum and lime; calcareous; strongly alkaline; clear wavy boundary.

C2cacs—44 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; massive; very hard, friable, slightly sticky and slightly plastic; few fine seams and soft masses of gypsum and lime; calcareous; strongly alkaline.

Coarse fragments are throughout the solum in a few pedons. The B2t horizon is about 40 to 45 percent clay. The C horizon is less than 15 percent lime and gypsum.

Barcus series

The Barcus series consists of deep, somewhat excessively drained soils on alluvial fans and in narrow valleys. These soils formed in mixed alluvium derived from calcareous sandstone and shale. Slope is 2 to 8 percent. Average annual precipitation is about 15 inches, and average annual air temperature is about 43 degrees F.

These soils are sandy-skeletal, mixed, frigid Ustic Torrifluvents.

Typical pedon of Barcus channery loamy sand, 2 to 8 percent slopes, 1.5 miles up Ryan Gulch Road from Piceance Road; 200 feet north of the road in the SE1/4SE1/4 of sec. 31, T. 1 S., R. 98 W.

A1—0 to 6 inches; pale brown (10YR 6/3) channery loamy sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; 20 percent fine channery fragments; calcareous; moderately alkaline; clear wavy boundary.

C1—6 to 16 inches; light yellowish brown (10YR 6/4) channery sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; 20 percent fine channery fragments; calcareous; moderately alkaline; clear wavy boundary.

C2—16 to 21 inches; light yellowish brown (10YR 6/4) very channery sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; 50 percent channery fragments and 5 percent flagstones; calcareous; moderately alkaline; clear wavy boundary.

C3—21 to 37 inches; light yellowish brown (10YR 6/4) very channery sand, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; 40 percent channery fragments; calcareous; strongly alkaline; abrupt wavy boundary.

C4—37 to 42 inches; pale brown (10YR 6/3) very channery loamy fine sand, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; 35 percent fine channery fragments; calcareous; strongly alkaline; abrupt wavy boundary.

C5—42 to 60 inches; light yellowish brown (10YR 6/4) very channery sand, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; 40 percent fine channery fragments; calcareous; strongly alkaline.

The profile is 60 inches thick or more. Between depths of 10 and 40 inches, it is 35 to 50 percent or more coarse fragments. The 10- to 40-inch control section averages very channery loamy sand. It consists of lenses that range from loamy fine sand to extremely channery coarse sand and is pale brown, light yellowish brown, or very pale brown. Except for the A horizon in some pedons, the profile is calcareous throughout. The A horizon is 15 to 35 percent channery fragments. It is light brownish gray or pale brown. Some pedons have a thin, darker colored buried A horizon.

Begay series

The Begay series consists of deep, well drained soils on broad alluvial fans and uplands. These soils formed in calcareous alluvium derived from sedimentary rock. Slope is 2 to 7 percent. Average annual precipitation is about 12 inches, and average annual air temperature is about 38 degrees F.

These soils are coarse-loamy, mixed, mesic Ustollic Camborthids.

Typical pedon of a Begay fine sandy loam in an area of Potts-Begay fine sandy loams, 2 to 7 percent slopes, about 0.25 mile east of Utah state line; 0.5 mile southwest of Raven Ridge and 0.4 mile north of fork in trail in the NE1/4SE1/4 of sec. 10, T. 2 N., R. 104 W.

A11—0 to 3 inches; light yellowish brown (10YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; moderately alkaline; clear wavy boundary.

A12—3 to 9 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; moderately alkaline; clear wavy boundary.

B2—9 to 18 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard,

very friable, nonsticky and nonplastic; calcareous; strongly alkaline; clear wavy boundary.
C1—18 to 30 inches; pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; less than 5 percent fine channery fragments; calcareous; strongly alkaline; gradual smooth boundary.
C2—30 to 60 inches; pink (7.5YR 7/4) loamy fine sand, light yellowish brown (7.5YR 6/4) moist; massive; soft, very friable; calcareous; strongly alkaline.

The profile is 0 to 5 percent coarse fragments, mostly less than 3/4 inch in diameter. Depth to uniformly calcareous material ranges from 0 to 30 inches. The profile has hue of 7.5YR or 10YR. The 10- to 40-inch control section is 7 to 15 percent clay. The A horizon has value of 5 or 6 when dry and 4 or 5 when moist, and it has chroma of 3 or 4.

Billings series

The Billings series consists of deep, well drained soils on alluvial valley floors, flood plains, narrow valley floors, and terraces. These soils formed in calcareous, silty alluvium derived dominantly from shale. Slope is 0 to 5 percent. Average annual precipitation is about 8 inches, and average annual air temperature is about 48 degrees F.

These soils are fine-silty, mixed (calcareous), mesic Typic Torrifluvents.

Typical pedon of Billings silty clay loam, 0 to 5 percent slopes, 1,900 feet west and 2,600 feet north of the southeast corner of sec. 36, T. 2 N., R. 103 W.

A11—0 to 2 inches; light gray (2.5Y 7/2) light silty clay loam, grayish brown (2.5Y 5/2) moist; strong thin and medium platy structure; slightly hard, friable, sticky and slightly plastic; calcareous; moderately alkaline; abrupt smooth boundary.
A12—2 to 6 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; moderate medium to very thick platy structure parting to moderate fine subangular blocky; slightly hard, friable, sticky and plastic; calcareous; moderately alkaline; abrupt smooth boundary.
C1—6 to 36 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine filaments and seams of gypsum; calcareous; moderately alkaline; clear wavy boundary.
C2—36 to 60 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and slightly plastic; calcareous; strongly alkaline.

The profile ranges from mildly alkaline to strongly alkaline and is nonsaline or slightly saline. It has hue of 5Y to 10YR. Fine gypsum, where present, generally is below a depth of 18 inches and is less than 5 percent of the profile. Weak mottles of very pale brown, yellow, or brownish yellow are below a depth of 24 inches in some pedons.

Blakabin series

The Blakabin series consists of deep, well drained soils on mountainsides. These soils formed in residuum and colluvium derived from interbedded shale and sandstone. Slope is 5 to 50 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are fine, montmorillonitic Typic Cryoborolls.

Typical pedon of a Blakabin clay loam in an area of Blakabin-Rhone-Waybe complex, 5 to 50 percent slopes, about 24 miles south and 4 miles east of the town of Rangely; about 1,200 feet south and 580 feet east of the northwest corner of sec. 3, T. 4 S., R. 101 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable, sticky and plastic; 10 percent fine sandstone channery fragments; calcareous; moderately alkaline; clear smooth boundary.
B21—3 to 14 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to strong fine angular blocky; hard, friable, sticky and plastic; 10 percent fine sandstone channery fragments; calcareous; moderately alkaline; clear wavy boundary.
B22—14 to 25 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; strong fine angular blocky structure; hard, firm, sticky and plastic; 10 percent channery fragments of fine sandstone; calcareous; moderately alkaline; clear wavy boundary.
B3ca—25 to 32 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; strong fine and medium angular blocky structure; hard, firm, sticky and plastic; few fine filaments of visible secondary calcium carbonate; 10 percent fine sandstone and shale channery fragments; calcareous; moderately alkaline; clear wavy boundary.
C1ca—32 to 50 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak fine and medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium seams and soft masses of visible secondary calcium carbonate; 15 percent fine sandstone and shale

channery fragments; calcareous; moderately alkaline; clear wavy boundary.
C2ca—50 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, friable, sticky and plastic; many fine and medium seams and soft masses of visible secondary calcium carbonate; 5 percent fine sandstone and shale channery fragments; calcareous; strongly alkaline.

Depth to uniformly calcareous material ranges from 0 to 16 inches. The mollic epipedon ranges from 7 to 16 inches in thickness. The 10- to 40-inch control section is clay loam, silty clay loam, or light clay and is 35 to 50 percent clay. The profile is 0 to 15 percent channery fragments of sandstone and shale less than 3 inches in diameter.

The A1 horizon has hue of 2.5Y or 10YR, value of 4 or 5 when dry, and chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

The B horizon has hue of 2.5Y or 10YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 2 or 3.

The C horizon has hue of 2.5Y or 10YR, and it has chroma of 1 to 3. It is moderately alkaline or strongly alkaline.

Blazon series

The Blazon series consists of shallow, well drained soils on foothills and ridges. These soils formed in residuum derived from marine shale. Slope is 8 to 65 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 43 degrees F.

These soils are loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents.

Typical pedon of a Blazon channery loam in an area of Blazon, moist-Rentsac complex, 8 to 65 percent slopes, in the NE1/4SW1/4 of sec. 14, T. 1 N., R. 94 W.

A11—0 to 4 inches; brown (10YR 5/3) channery loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure parting to moderate fine and medium granular; slightly hard, very friable, slightly sticky and nonplastic; 15 to 25 percent sandstone fragments; calcareous; moderately alkaline; clear smooth boundary.
A12—4 to 11 inches; brown (10YR 5/3) channery clay loam, brown (10YR 4/3) moist; moderate medium and coarse subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; 15 to 25 percent sandstone fragments; calcareous; moderately alkaline; clear wavy boundary.
C1ca—11 to 16 inches; light yellowish brown (10YR 6/4) shaly clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure parting to strong fine subangular blocky; slightly hard, friable, sticky and plastic; 40 percent fine shale chips, 25 percent of which breaks down readily by shaking or rubbing; soft masses and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.
Cr—16 inches; fractured marine shale.

Depth to bedrock ranges from 10 to 20 inches. Coarse fragments make up 15 to 25 percent of the A horizon and 35 to 50 percent of the solum. Some visible carbonates and gypsum crystals are in the profile and between the plates of weathered shale. The A horizon is brown or grayish brown. The C1 or C1ca horizon is light yellowish brown, brown, or yellowish brown.

Bucklon series

The Bucklon series consists of shallow, well drained soils on mountainsides and low ridges. These soils formed in residuum derived from shale and sandstone. Slope is 25 to 50 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 38 degrees F.

These soils are loamy, mixed, shallow Typic Cryoborolls.

Typical pedon of a Bucklon loam in an area of Bucklon-Inchau loams, 25 to 50 percent slopes, 2,200 feet south and 300 feet west of the northeast corner of sec. 9, T. 4 S., R. 94 W.

A1—0 to 10 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure parting to moderate fine crumb and granular; soft, very friable, slightly sticky and slightly plastic; scattered rock fragments; neutral; clear smooth boundary.
C1—10 to 17 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 10 percent channery rock fragments; neutral; clear wavy boundary.
Cr—17 inches; variegated interbedded sandstone and shale.

Depth to bedrock ranges from 10 to 20 inches. The mollic epipedon is 7 to 12 inches thick. The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3. The C horizon commonly has hue of 10YR or 2.5Y, but hue is 7.5YR in some pedons. Small, slightly calcareous spots are in the lower part of the C horizon.

Bulkley series

The Bulkley series consists of deep, well drained soils on rolling upland ridges, benches, and hillsides. These soils formed in residuum and colluvium derived from

calcareous clayey shale. Slope is 5 to 30 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 43 degrees F.

These soils are fine, montmorillonitic, frigid Udorthentic Chromusterts.

Typical pedon of a Bulkley clay loam in an area of Bulkley-Abor clay loams, 5 to 30 percent slopes, 100 feet south and 200 feet east of the center of sec. 29, T. 3 N., R. 91 W.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure parting to moderate medium granular; very hard, firm, sticky and plastic; common cracks 1 inch to 3 inches wide; moderately alkaline; clear wavy boundary.

B21—3 to 17 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; common cracks 1 inch to 3 inches wide; calcareous; moderately alkaline; clear wavy boundary.

B22—17 to 29 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and plastic; common cracks 1 inch to 2 inches wide; calcareous; moderately alkaline; clear wavy boundary.

C1ca—29 to 58 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, sticky and plastic; common cracks as much as 1 inch wide in the upper part; 5 percent gravel; common to many fine and medium seams and soft masses of lime; calcareous; moderately alkaline; gradual smooth boundary.

Cr—58 inches; soft shale.

The A horizon is 0 to 10 percent basalt cobbles and stones. It typically is clay loam, but in some pedons it is channery silty clay loam.

Burnette series

The Burnette series consists of deep, well drained soils on ridges, hillsides, and mountainsides. The soils formed in material derived dominantly from shale. Slope is 5 to 20 percent. Average annual precipitation is 18 to 20 inches, and average annual air temperature is about 38 degrees F.

These soils are fine, montmorillonitic Argic Pachic Cryoborolls.

Typical pedon of a Burnette loam in an area of Owen Creek-Jerry-Burnette loams, 5 to 35 percent slopes, 2,000 feet east and 1,200 feet north of the southwest corner of sec. 32, T. 3 N., R. 93 W.

A11—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure parting to moderate medium and coarse granular; slightly hard, friable, slightly sticky and plastic; neutral; clear smooth boundary.

A12—5 to 10 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, sticky and plastic; neutral; clear wavy boundary.

B21t—10 to 22 inches; brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; moderate medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, firm, sticky and plastic; mildly alkaline; clear smooth boundary.

B22t—22 to 30 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate medium and coarse subangular blocky structure; extremely hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

B3ca—30 to 38 inches; light brownish gray (2.5Y 6/2) clay, olive brown (2.5Y 4/4) moist; common fine and medium distinct white (2.5Y 8/2) and yellowish brown (10YR 5/6) mottles, pale yellow (2.5Y 8/4) and yellowish brown (10YR 5/4) moist; weak medium and coarse subangular blocky structure; extremely hard, firm, sticky and plastic; small soft masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C1ca—38 to 60 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; common fine and medium distinct white (10YR 8/1) and light olive brown (2.5Y 5/6) mottles, light gray (10YR 7/2) and light olive brown (2.5Y 5/4) moist; weak medium and coarse subangular blocky structure; extremely hard, firm, sticky and plastic; 10 percent small shale chips; many fine and medium soft masses and seams of secondary calcium carbonate; calcareous; moderately alkaline.

The mollic epipedon is 16 to 26 inches thick. The noncalcareous part of the solum is 18 to 30 inches thick. Channery fragments make up less than 15 percent of the profile.

The A horizon has hue of 2.5Y to 7.5YR, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 1 to 3.

The B2t horizon has hue of 2.5Y or 10YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 1 to 4. It is silty clay or clay.

The C horizon has hue of 2.5Y or 10YR, value of 5 or 6 when dry and 3 to 5 when moist, and chroma of 1 to 6. It is clay loam, silty clay, or clay.

Castner series

The Castner series consists of shallow, well drained soils on uplands, mountainsides, and ridgetops. These soils formed in residuum derived from sandstone. Slope is 5 to 50 percent. Average annual precipitation is 16 inches, and average annual air temperature is 40 degrees F.

These soils are loamy-skeletal, mixed Lithic Haploborolls.

Typical pedon of Castner channery loam, 5 to 50 percent slopes, about 1,200 feet west and 2,450 feet north of the southeast corner of sec. 21, T. 1 S., R. 96 W.

A11—0 to 3 inches; dark grayish brown (10YR 4/2) channery light loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure parting to moderate very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; 25 percent channery fragments; mildly alkaline; clear wavy boundary.

A12—3 to 7 inches; dark grayish brown (10YR 4/2) channery light loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure parting to moderate very fine and fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; 25 percent channery fragments; mildly alkaline; clear wavy boundary.

A13—7 to 11 inches; dark grayish brown (10YR 4/2) very channery loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 45 percent channery fragments; moderately alkaline; clear wavy boundary.

Cca—11 to 17 inches; grayish brown (10YR 5/2) very channery loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; 45 percent channery fragments and 5 percent flagstones; calcareous; moderately alkaline; gradual wavy boundary.

R—17 inches; variegated gray and brown sandstone.

Channery fragments commonly are on the surface. Depth to bedrock is 10 to 20 inches. The A11 and A12 horizons are 15 to 35 percent channery fragments. Calcium carbonate, where present, is barely visible and in some pedons is on the underside of rock fragments.

Chipeta series

The Chipeta series consists of shallow, well drained soils on low, rolling hills, on ridges, and on toe slopes. These soils formed in residuum derived from calcareous, gypsiferous shale. Slope is 3 to 25 percent. Average annual precipitation is about 8 inches, and average annual air temperature is about 48 degrees F.

These soils are clayey, mixed (calcareous), mesic, shallow Typic Torriorthents.

Typical pedon of the Chipeta silty clay loam, 3 to 25 percent slopes, 1,050 feet north and 1,625 feet east of the southwest corner of sec. 27, T. 2 N., R. 102 W.

A11—0 to 3 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; moderate thick platy structure in upper part and weak fine granular structure in lower part; slightly hard, friable, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

AC—3 to 9 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 5/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

C1cs—9 to 18 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 5/2) moist; massive; hard, firm, sticky and plastic; many very fine platy shale chips that break down easily when rubbed; few fine threads of calcium carbonate; many fine crystals and seams of gypsum; calcareous; moderately alkaline; clear wavy boundary.

Cr—18 inches; slightly weathered platy shale.

Depth to bedrock ranges from 14 to 20 inches. The profile is about 2 to 10 percent gypsum. Salinity is slight or moderate. Hue is 5Y to 10YR throughout the profile.

Clayburn series

The Clayburn series consists of deep, well drained soils in concave areas of mountainsides, toe slopes, and ridgetops. These soils formed in alluvium and colluvium derived from mixed sedimentary rock. Slope is 3 to 15 percent. Average annual precipitation is about 20 inches, and average annual air temperature is 38 degrees F.

These soils are fine-loamy, mixed Argic Pachic Cryoborolls.

Typical pedon of Clayburn loam, 3 to 15 percent slopes, in the SW1/4SW1/4 of sec. 9, T. 1 S., R. 92 W.

A11—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure and subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent fine shale chips; neutral; clear wavy boundary.

A12—4 to 14 inches; dark grayish brown (10YR 4/2) heavy loam, very dark brown (10YR 2/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and plastic; 10 percent fine shale chips; neutral; clear wavy boundary.

B21t—14 to 22 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky

structure; hard, friable, sticky and plastic; 10 percent fine shale chips; neutral; clear wavy boundary.

B22t—22 to 34 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; 15 percent fine shale chips; neutral; clear wavy boundary.

C1—34 to 60 inches; grayish brown (10YR 5/2) light clay loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, sticky and plastic; 15 percent fine shale and sandstone fragments; mildly alkaline.

The profile is 0 to 15 percent rock fragments that generally are less than 1 inch across and 1/4 inch thick. Below a depth of 34 inches, the content of rock fragments is as much as 25 percent and the fragments are as much as 3 inches across and 1.5 inches thick.

Cliffdown series

The Cliffdown series consists of deep, somewhat excessively drained soils on side slopes of terraces. These soils formed in mixed gravelly and cobbly alluvium. Slope is 5 to 8 percent. Average annual precipitation is about 8 inches, and average annual air temperature is about 48 degrees F.

These soils are loamy-skeletal, mixed (calcareous), mesic Typic Torriorthents.

Typical pedon of a Cliffdown gravelly loam in an area of Cliffdown-Cliffdown Variant complex, 5 to 65 percent slopes, in the SE1/4SW1/4 of sec. 5, T. 1 N., R. 102 W.

A1—0 to 5 inches; pale brown (10YR 6/3) gravelly loam, grayish brown (10YR 5/2) moist; weak coarse platy structure parting to weak fine granular; slightly hard, very friable, slightly sticky and nonplastic; 20 percent coarse fragments; calcareous; moderately alkaline; clear smooth boundary.

C1ca—5 to 26 inches; light gray (10YR 7/2) very gravelly sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; 50 percent coarse fragments; lime coatings on underside of rock fragments; calcareous; strongly alkaline; clear wavy boundary.

C2ca—26 to 60 inches; light gray (10YR 7/2) stratified very gravelly loamy sand and sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable, nonsticky and nonplastic; 70 percent rock fragments; lime coatings on underside of rock fragments; calcareous; moderately alkaline.

The profile is slightly saline or moderately saline. It has hue of 2.5Y to 7.5YR. The A horizon is 10 to 30 percent gravel and cobbles. The C1ca horizon is 35 to 60 percent gravel and cobbles that have lime coatings on the underside and are slightly cemented in some pedons.

Cliffdown Variant

The Cliffdown Variant consists of moderately deep, well drained soils on terrace side slopes. These soils formed in calcareous, gravelly and cobbly alluvium underlain by soft, highly weathered, clayey shale. Slope is 8 to 65 percent. Average annual precipitation is about 8 inches, and average annual air temperature is about 48 degrees F.

These soils are fine-loamy, mixed (calcareous), mesic Typic Torriorthents.

Typical pedon of a Cliffdown Variant very cobbly loam in an area of Cliffdown-Cliffdown Variant complex, 5 to 65 percent slopes, about 400 feet east and 150 feet north of the southwest corner of sec. 3, T. 1 N., R. 102 W.

A1—0 to 7 inches; pale brown (10YR 6/3) very cobbly loam, brown (10YR 4/3) moist; weak medium to coarse subangular blocky structure parting to moderate granular; soft, friable, slightly sticky and slightly plastic; 20 percent cobbles and 30 percent gravel; calcareous; moderately alkaline; clear smooth boundary.

AC—7 to 13 inches; brown (10YR 5/3) very gravelly loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 60 percent gravel and scattered cobbles; calcareous; moderately alkaline; clear smooth boundary.

C1ca—13 to 24 inches; light brownish gray (2.5Y 6/2) gravelly clay loam, dark grayish brown (2.5Y 4/2) moist; moderate very fine to medium subangular blocky structure; hard, firm, sticky and plastic; 35 percent shale fragments and scattered cobbles; visible soft masses and coatings of secondary calcium carbonate on gravel; calcareous; strongly alkaline; gradual wavy boundary.

Cr—24 to 60 inches; grayish brown (2.5Y 5/2) highly weathered clayey shale, dark grayish brown (2.5Y 4/2) moist; hard, firm, sticky and plastic after prolonged wetting and rubbing; many clayey shale chips; calcareous; strongly alkaline.

Depth to weathered shale ranges from 20 to 40 inches. Depth to hard shale generally is more than 40 inches. The A1 horizon is 35 to 60 percent cobbles and pebbles. The AC horizon is 40 to 65 percent pebbles and cobbles that have thin coatings of calcium carbonate on the underside.

Clifterson series

The Clifterson series consists of deep, well drained to somewhat excessively drained soils on alluvial fans, foot

slopes, and terraces. These soils formed in alluvium and colluvium weathered mainly from calcareous hard shale. Slope is 1 to 15 percent. Average annual precipitation is about 8 inches, and average annual air temperature is about 48 degrees F.

These soils are loamy-skeletal, mixed (calcareous), mesic Typic Torriorthents.

Typical pedon of Clifterson channery loam, 1 to 15 percent slopes, 1,475 feet north and 350 feet east of the southwest corner of sec. 10, T. 1 N., R. 103 W.

A1—0 to 4 inches; light brownish gray (2.5Y 6/2) channery loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to moderate very fine and fine granular; slightly hard, friable, slightly sticky and slightly plastic; 20 percent fine channery fragments; calcareous; strongly alkaline; clear wavy boundary.

C1—4 to 22 inches; pale brown (10YR 6/3) very channery loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 35 percent fine channery fragments; calcareous; strongly alkaline; gradual wavy boundary.

C2ca—22 to 60 inches; light gray (2.5Y 7/2) very channery loam, light brownish gray (2.5Y 6/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 40 to 70 percent channery fragments; thin coatings of secondary calcium carbonate on underside of coarse fragments; calcareous; moderately alkaline.

In some pedons the A horizon is as much as 35 percent channery fragments and as much as 15 percent flagstones that are 10 inches across or less. Depth to the Cca horizon ranges from 8 to 24 inches.

Cochetopa series

The Cochetopa series consists of deep, well drained soils on mountainsides and fans. These soils formed in alluvium and colluvium derived from sandstone and basalt. Slope is 9 to 50 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are fine, montmorillonitic Argic Pachic Cryoborolls.

Typical pedon of Cochetopa loam, 9 to 50 percent slopes, on the right fork in the road, in the NW1/4SW1/4 of sec. 27, T. 3 N., R. 91 W.

A11—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent gravel and cobbles; neutral; gradual smooth boundary.

A12—8 to 19 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to moderate medium granular; hard, friable, slightly sticky and slightly plastic; 10 percent gravel and cobbles; neutral; gradual wavy boundary.

B21t—19 to 29 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and plastic; many thin clay films on ped faces and in pores; 5 percent gravel and cobbles; neutral; gradual wavy boundary.

B22t—29 to 44 inches; yellowish brown (10YR 5/4) clay, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium angular blocky; extremely hard, firm, sticky and plastic; many moderately thick clay films on ped faces and in pores; 5 percent gravel and cobbles; mildly alkaline; diffuse wavy boundary.

C1—44 to 60 inches; grayish brown (10YR 5/2) clay loam, brown (10YR 4/3) moist; massive; hard, friable, sticky and plastic; 5 percent gravel and cobbles; mildly alkaline.

The mollic epipedon is 17 to 28 inches thick. The profile has hue of 10YR or 7.5YR. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 1 to 3. The B horizon has value of 4 to 6 when dry and 2 to 5 when moist, and it has chroma of 1 to 4.

Colorow series

The Colorow series consists of deep, moderately well drained soils on alluvial valley floors, flood plains, fans, and low terraces. These soils formed in mixed alluvium derived from sandstone. Slope is 0 to 3 percent. Average annual precipitation is about 10 inches, and average annual air temperature is about 48 degrees F.

These soils are coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of Colorow sandy loam, 1,600 feet west and 900 feet north of the southeast corner of sec. 4, T. 1 N., R. 102 W.

A1—0 to 5 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; moderate to strong very fine to medium platy structure; slightly hard, very friable, nonsticky and nonplastic; calcareous; mildly alkaline; clear smooth boundary.

C1—5 to 32 inches; light brownish gray (10YR 6/2) stratified loam and fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse and very coarse platy structure; slightly hard, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; abrupt smooth boundary.

C2—32 to 43 inches; pale brown (10YR 6/3) stratified fine sandy loam and loamy fine sand, grayish brown (10YR 5/2) moist; common distinct yellowish brown

(10YR 5/8) and brownish yellow (10YR 6/6) mottles; massive; soft, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; abrupt smooth boundary.

C3—43 to 60 inches; pale brown (10YR 6/3) stratified sandy loam and sand, grayish brown (10YR 5/3) moist; common distinct very pale brown (10YR 7/3) and yellowish brown (10YR 5/6) mottles; massive; soft, very friable, nonsticky and nonplastic; mildly alkaline.

The profile is 0 to 10 percent coarse fragments, mainly gravel. The water table fluctuates between depths of 4 and 6 feet. The C horizon has strata of light loam to loamy sand that range from 1 inch to several inches in thickness.

Cowdrey series

The Cowdrey series consists of deep, well drained soils on high mountainsides and toe slopes. These soils formed in colluvium derived from sandstone and shale. Slope is 15 to 50 percent. Average annual precipitation is about 25 inches, and average annual air temperature is about 38 degrees F.

These soils are fine, montmorillonitic Typic Cryoboralfs.

Typical pedon of a Cowdrey loam in an area of Cowdrey-Tampico loams, 15 to 50 percent slopes, about 400 feet west and 125 feet north of the east quarter corner of sec. 29, T. 1 N., R. 90 W.

O1—2 inches to 1 inch; undecomposed pine needles, twigs, cones, and leaves.

O2—1 inch to 0; decomposing organic matter.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; 5 percent gravel and cobbles; slightly acid; abrupt smooth boundary.

A2—4 to 12 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate very fine and fine subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent gravel and cobbles; slightly acid; gradual wavy boundary.

A&B—12 to 16 inches; pale brown (10YR 6/3) and pinkish gray (7.5YR 6/2) loam and small pockets of clay loam, brown (10YR 4/3 and 7.5YR 4/4) moist; moderate fine and medium subangular blocky and granular structure; slightly hard, friable, slightly sticky and slightly plastic; 5 percent gravel and cobbles; slightly acid; gradual wavy boundary.

B2t—16 to 34 inches; light brown (7.5YR 6/4) cobbly clay, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; 20 percent channery fragments and angular cobbles; thin patchy clay films on ped faces and coarse fragments; neutral; clear wavy boundary.

C1—34 to 60 inches; brown (7.5YR 5/4) cobbly light clay, dark brown (7.5YR 4/4) moist; massive; hard, firm, sticky and plastic; 20 percent channery fragments and angular cobbles; neutral.

The B horizon is 40 to 50 percent clay. The upper 16 inches of the profile generally is less than 15 percent rock fragments; below this depth the content of rock fragments is as much as 35 percent.

Curecanti series

The Curecanti series consists of deep, well drained soils on fans, stream terraces, toe slopes, and terrace breaks. These soils formed in glacial outwash. Slope is 1 to 8 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 40 degrees F.

These soils are loamy-skeletal, mixed Aridic Argiborolls.

Typical pedon of Curecanti very cobbly loam, 1 to 8 percent slopes, 350 feet south and 400 feet east of the northwest corner of sec. 29, T. 1 N., R. 90 W.

A1—0 to 9 inches; dark brown (7.5YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate medium to coarse granular structure; soft, friable, slightly sticky and slightly plastic; 20 percent gravel and 25 percent cobbles; slightly acid; clear smooth boundary.

B2t—9 to 16 inches; brown (7.5YR 4/4) very cobbly sandy clay loam, dark brown (7.5YR 3/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; 35 percent gravel and 20 percent cobbles; common moderately thick clay films on ped faces; slightly acid; clear wavy boundary.

B3—16 to 24 inches; brown (7.5YR 4/4) very cobbly sandy loam, dark yellowish brown (10YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 30 to 50 percent gravel and 15 to 25 percent cobbles; slightly acid; clear wavy boundary.

C1—24 to 60 inches; brown (7.5YR 4/4) very cobbly loamy sand; single grain; loose, 35 to 55 percent gravel and 20 to 30 percent cobbles; medium acid.

The solum averages 35 to 60 percent gravel and cobbles, and the content increases with depth. The solum is medium acid to neutral. The A horizon has hue of 10YR to 7.5YR. The B2t horizon has hue of 7.5YR to 2.5Y. It is very cobbly or very gravelly sandy clay loam or light clay loam. The C horizon is very gravelly, extremely gravelly, or cobbly sandy loam to loamy sand.

Delson series

The Delson series consists of deep, well drained soils on fans, mountainsides, and benches. These soils formed in moderately fine textured alluvium and colluvium derived from basalt and sedimentary rock. Slope is 3 to 25 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 40 degrees F.

These soils are fine, montmorillonitic Typic Argiborolls.

Typical pedon of a Delson stony loam in an area of Delson-Perma complex, 3 to 65 percent slopes, about 30 feet south of cattle guard on Buford-New Castle road; in the SE1/4NW1/4 of sec. 20, T. 1 S., R. 91 W.

A1—0 to 12 inches; dark brown (7.5YR 4/2) stony loam, dark brown (7.5YR 3/2) moist; moderately fine and medium crumb structure; slightly hard, very friable, slightly sticky and slightly plastic; 3 percent stones; neutral; clear wavy boundary.

B21t—12 to 16 inches; reddish brown (5YR 4/3) stony clay loam, dark reddish brown (5YR 3/4) moist; strong fine to medium subangular blocky structure; hard, firm, sticky and very plastic; 10 percent stones; neutral; clear wavy boundary.

B22t—16 to 30 inches; reddish brown (5YR 5/3) stony clay, reddish brown (5YR 4/4) moist; strong medium and coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; 15 percent stones; neutral; gradual smooth boundary.

B3—30 to 40 inches; reddish brown (5YR 4/3) stony clay, dark reddish brown (5YR 3/4) moist; moderate coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; 20 percent stones; neutral; gradual smooth boundary.

C1—40 to 60 inches; reddish brown (5YR 5/3) stony clay loam, reddish brown (5YR 4/3) moist; massive; hard, friable, sticky and plastic; 30 percent stones; mildly alkaline.

Weak lime deposits are in the C horizon in a few pedons. The A horizon is slightly acid or neutral. It is stony loam or channery loam.

Dollard series

The Dollard series consists of moderately deep, well drained soils on foot slopes, foothills, and ridges. These soils formed in residuum and colluvium derived from shale. Slope is 3 to 50 percent. Average annual precipitation is about 14 inches, and average annual air temperature is about 43 degrees F.

These soils are fine, montmorillonitic (calcareous), frigid Ustic Torriorthents.

Typical pedon of Dollard silty clay loam, 15 to 40 percent slopes, about 1,000 feet north and 2,450 feet west of the southeast corner of the SW1/4SE1/4 of sec. 29, T. 2 N., R. 97 W.

A1—0 to 3 inches; very pale brown (10YR 7/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; soft, very friable, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

AC—3 to 11 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; very hard, firm, sticky and plastic; calcareous; moderately alkaline; clear wavy boundary.

Cca—11 to 26 inches; yellow (10YR 7/6) silty clay loam, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; very hard, firm, sticky and plastic; few faint concretions of secondary calcium carbonate; calcareous; strongly alkaline; clear wavy boundary.

Cr—26 inches; weathered, calcareous clayey shale.

The depth to paralithic contact ranges from 20 to 40 inches. Coarse fragments, mainly shale, make up 0 to 5 percent of the profile. They are 1/4 to 3/4 inch in diameter.

Forelle series

The Forelle series consists of deep, well drained soils on uplands and terraces. These soils formed in calcareous eolian and alluvial material derived dominantly from sedimentary rock. Slope is 3 to 15 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 43 degrees F.

These soils are fine-loamy, mixed Borollic Haplargids.

Typical pedon of Forelle loam, 3 to 8 percent slopes, about 1,000 feet east and 1,500 feet south of the northwest corner of sec. 19, T. 1 N., R. 93 W.

A1—0 to 4 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

B2t—4 to 16 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine patchy clay films; calcareous; moderately alkaline; clear smooth boundary.

B3ca—16 to 21 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine soft masses of calcium carbonate; strongly alkaline; clear wavy boundary.

C1ca—21 to 40 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium

subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine soft masses of lime; calcareous; strongly alkaline; gradual wavy boundary.

C2—40 to 60 inches; very pale brown (10YR 7/3) loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; calcareous; strongly alkaline.

Depth to a strong concentration of calcium carbonate ranges from 8 to 20 inches. Content of rock fragments commonly is less than 5 percent but in some pedons ranges from 0 to 15 percent. The A and B horizons in places are calcareous. The B horizon is loam to clay loam.

Gaynor series

The Gaynor series consists of moderately deep, well drained soils on gently undulating to rolling low hills and ridges. These soils formed in calcareous residuum derived from shale. Slope is 2 to 15 percent. Average annual precipitation is about 12 inches, and average annual air temperature is about 48 degrees F.

These soils are fine, montmorillonitic (calcareous), mesic Ustic Torriorthents.

Typical pedon of a Gaynor silty clay loam in an area of Gaynor-Midway silty clay loams, dry, 2 to 25 percent slopes, about 1,200 feet north and 450 feet east of the southwest corner of sec. 21, T. 1 N., R. 103 W.

A11—0 to 2 inches; pale brown (10YR 6/3) silty clay loam, light yellowish brown (10YR 6/4) moist; weak fine platy structure parting to weak very fine granular; soft, very friable, very sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

A12—2 to 8 inches; very pale brown (10YR 7/4) silty clay, light yellowish brown (10YR 6/4) moist; weak coarse platy structure; slightly hard, friable, very sticky and very plastic; calcareous; moderately alkaline; gradual wavy boundary.

AC—8 to 21 inches; pale brown (10YR 6/3) silty clay, light yellowish brown (10YR 6/4) moist; common fine and medium faint white (10YR 8/2) mottles; medium coarse prismatic structure parting to medium coarse angular blocky; very hard, firm, very sticky and very plastic; calcareous; moderately alkaline; gradual wavy boundary.

C1ca—21 to 29 inches; light yellowish brown (10YR 6/4) silty clay, light yellowish brown (10YR 6/4) moist; massive; very hard, firm, very sticky and very plastic; many small flakes of partially weathered grayish brown fissile shale; common fine specks and nests of white gypsum; calcareous; moderately alkaline; abrupt wavy boundary.

C2r—29 to 35 inches; grayish brown (2.5Y 5/2) fragments of fissile shale less than 1 inch square and 3/64 inch thick; yellow (2.5Y 7/6) coatings on fragments, grayish brown (2.5Y 5/2) moist; moderately alkaline; calcareous; abrupt smooth boundary.

IICr1—35 to 40 inches; yellow (10YR 8/6) horizontally bedded fine-grained sandstone, yellow (10YR 7/6) moist; calcareous; moderately alkaline; abrupt smooth boundary.

IICr2—40 inches; light grayish brown (2.5Y 6/2) fractured shale, grayish brown (2.5Y 5/2) moist; tops of some plates are yellow (2.5Y 8/8).

These soils have cracks at the surface that are 3/4 inch to 1 1/2 inches thick.

Glendive series

The Glendive series consists of deep, well drained soils along drainageways on alluvial valley floors. These soils formed in alluvium. Slope is 2 to 4 percent. Average annual precipitation is about 15 inches, and average annual air temperature is about 43 degrees F.

These soils are coarse-loamy, mixed (calcareous), frigid Ustic Torrifluvents.

Typical pedon of Glendive fine sandy loam, 600 feet west and 200 feet north of the southeast corner of sec. 1, T. 2 S., R. 98 W.

A11—0 to 2 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine platy structure; soft, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; abrupt wavy boundary.

A12—2 to 6 inches; very pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; clear wavy boundary.

C1—6 to 26 inches; very pale brown (10YR 7/3) stratified fine sandy loam and very fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; calcareous; strongly alkaline; clear wavy boundary.

C2—26 to 36 inches; very pale brown (10YR 7/3) light sandy clay loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; strongly alkaline; clear wavy boundary.

A1b—36 to 44 inches; pale brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and nonplastic; calcareous; strongly alkaline; abrupt wavy boundary.

C1b—44 to 60 inches; very pale brown (10YR 7/3) stratified fine sandy loam and loamy fine sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; calcareous; strongly alkaline.

The 10- to 40-inch control section is 5 to 15 percent fine channery fragments. Some pedons are nonsaline or slightly saline in some horizons above a depth of 40 inches.

Glenton series

The Glenton series consists of deep, well drained soils along intermittent drainageways and on terraces and alluvial fans. These soils formed in alluvium derived from sandstone. Slope is 1 to 6 percent. Average annual precipitation is about 7 to 9 inches, and average annual air temperature is about 48 degrees F.

These soils are coarse-loamy, mixed (calcareous), mesic Typic Torrifluvents.

Typical pedon of Glenton sandy loam, 1 to 6 percent slopes, about 13 miles west of Rangely; 2,280 feet north and 2,350 feet east of the southwest corner of sec. 2, T. 1 N., R. 104 W.

A1—0 to 10 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; 5 percent sandstone fragments; calcareous; strongly alkaline; gradual wavy boundary.

C1—10 to 13 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; 10 percent sandstone fragments; calcareous; strongly alkaline; gradual wavy boundary.

C2—13 to 48 inches; pale brown (10YR 6/3) fine sandy loam that has thin lenses of loamy sand, brown (10YR 5/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; 5 percent sandstone fragments; calcareous; moderately alkaline; gradual wavy boundary.

C3—48 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; 10 percent sandstone fragments; calcareous; moderately alkaline.

The control section commonly is 5 to 15 percent channery fragments less than 1 inch in diameter and less than 1/2 inch thick. The A horizon has hue of 2.5Y or 10YR, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 2 or 3. The C horizon has hue of 2.5Y to 10YR.

Guben series

The Guben series consists of deep, well drained soils on upland benches and terrace edges. These soils formed in a thin eolian deposit over calcareous alluvium and glacial outwash. Slope is 0 to 16 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 43 degrees F.

These soils are loamy-skeletal, mixed Typic Calciborolls.

Typical pedon of Guben loam, 3 to 8 percent slopes, 0.4 mile south and 50 feet east of the center of sec. 27, T. 1 N., R. 94 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

B2—6 to 11 inches; brown (10YR 5/3) heavy loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

B3ca—11 to 15 inches; pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

IIC1ca—15 to 23 inches; white (10YR 8/2) very gravelly loam, light gray (10YR 7/2) moist; massive; slightly hard, very friable, slightly sticky; 35 percent gravel and 15 percent cobbles; many medium soft lime masses within the fine earth fraction and many lime coatings on gravel; calcareous; moderately alkaline; clear wavy boundary.

IIC2ca—23 to 60 inches; white (10YR 8/2) very cobbly sandy loam that has large pockets of gravelly loam to loamy sand; light gray (10YR 7/2) moist; massive; slightly hard, very friable; 35 percent gravel and 30 percent cobbles; many lime coatings on rock fragments; calcareous; moderately alkaline.

Depth to the layer of calcium carbonate accumulation ranges from 8 to 20 inches. The control section is 35 to 65 percent coarse fragments. In some pedons the A horizon is as much as 20 percent gravel and cobbles.

Hagga series

The Hagga series consists of deep, poorly drained soils on alluvial valley floors and flood plains. These soils formed in alluvium derived from calcareous sedimentary rock. Slope is 0 to 5 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 43 degrees F.

These soils are fine-loamy mixed (calcareous), frigid Typic Fluvaquents.

Typical pedon of Hagga loam, 1,160 feet north of intersection of Ryan Gulch road and Piceance Creek Highway; 475 feet west of Piceance Creek Highway in the SW1/4NW1/4 of sec. 33, T. 1 S., R. 97 W.

A11—0 to 5 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure in the upper part and moderate

medium granular structure in the lower part; soft, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; abrupt wavy boundary.

A12—5 to 9 inches; light brownish gray (2.5Y 6/2) loamy fine sand, brown (10YR 5/3) moist; massive; soft, very friable; calcareous; moderately alkaline; abrupt wavy boundary.

A13g—9 to 27 inches; light brownish gray (2.5Y 6/2) light clay loam, dark grayish brown (10YR 4/2) moist; thin lenses that are dark brown (10YR 4/3) when moist; common fine distinct brown (10YR 5/3 and 7.5YR 4/4) mottles; moderate medium granular and subangular blocky structure; hard, friable, sticky and plastic; calcareous; moderately alkaline; abrupt wavy boundary.

C1g—27 to 31 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; few fine distinct brown (7.5YR 4/4) and dark grayish brown (2.5Y 4/2) mottles; massive; soft, very friable; calcareous; moderately alkaline; abrupt wavy boundary.

A1bg—31 to 37 inches; light brownish gray (2.5Y 6/2) light silty clay loam, brown (10YR 4/3) moist; common fine faint dark grayish brown (10YR 4/2 and 2.5Y 4/2) mottles; massive; hard, friable, sticky and plastic; calcareous; clear wavy boundary.

C1bg—37 to 60 inches; light gray (5Y 7/1) fine sandy loam, 70 percent olive gray (5Y 5/2) and 30 percent gray (N 5/0) when moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The water table is at a depth of 12 to 24 inches in spring and early in summer. A thin O horizon is in undisturbed areas and is less than 4 inches thick. The control section is dominantly silty clay loam, but it is stratified with lenses of loam to loamy fine sand 1 inch to 12 inches thick.

The A horizon has hue of 2.5Y or 10YR, value of 4 to 6 when moist and 5 or 6 when dry, and chroma of 3 or less when moist or dry. The C horizon has hue of 5BG to 10YR. Mottles in the A horizon range from faint to prominent and have hue of 10YR or 7.5YR, chroma of 3 to 6, and value of 5 or 6. In some pedons the part of the C horizon below a depth of 40 inches is underlain by silty or clayey material.

Havre series

The Havre series consists of deep, well drained soils on flood plains and low stream terraces. These soils formed in calcareous alluvium. Slope is 0 to 4 percent. Average annual precipitation is about 15 inches, and average annual air temperature is about 43 degrees F.

These soils are fine-loamy, mixed (calcareous), frigid Ustic Torrifluvents.

Typical pedon of Havre loam, 0 to 4 percent slopes, 700 feet west and 500 feet south of the center of sec. 29, T. 1 S., R. 98 W.

Ap—0 to 8 inches; light brownish gray (10YR 6/2) loam, brown (10YR 4/3) moist; weak coarse platy structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

A1—8 to 21 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

C1—21 to 40 inches; light gray (10YR 7/2) stratified loam and silty clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; calcareous; strongly alkaline; clear wavy boundary.

A1b—40 to 43 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; common fine distinct mottles that are yellowish brown (10YR 5/8) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; strongly alkaline; clear wavy boundary.

C1g—43 to 60 inches; light brownish gray (10YR 6/2) stratified loam and sandy loam, grayish brown (10YR 5/2) moist; many medium distinct mottles that are yellowish brown (10YR 5/8) when moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; strongly alkaline.

The 10- to 40-inch control section is 18 to 30 percent clay. Strata of sandy, silty, or clayey sediment 1/2 inch to more than 6 inches thick can occur at any depth in the profile. Some pedons have a buried A horizon and thin, strongly alkaline strata. Fine filaments or threads of lime or salt are throughout part or all of the C horizon in some pedons.

Inchau series

The Inchau series consists of moderately deep, well drained soils on mountainsides and ridges. These soils formed in residuum and colluvium derived from shale and sandstone. Slope is 25 to 40 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 38 degrees F.

These soils are fine-loamy, mixed Argic Cryoborolls.

Typical pedon of an Inchau loam in an area of Bucklon-Inchau loams, 25 to 50 percent slopes, about 800 feet north and 500 feet west of the southeast corner of sec. 28, T. 3 S., R. 94 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.
B1—5 to 11 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine rock fragments; neutral; clear wavy boundary.
B2t—11 to 22 inches; brown (10YR 5/3) gravelly clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 15 percent sandstone channery fragments; neutral; clear wavy boundary.
B3—22 to 28 inches; brown (10YR 5/3) gravelly loam, brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 20 percent sandstone channery fragments; neutral; gradual wavy boundary.
C1—28 to 35 inches; grayish brown (2.5Y 5/2) gravelly loam, dark grayish brown (2.5Y 5/2) moist; massive; hard, firm, slightly sticky and slightly plastic; 20 percent channery sandstone fragments and 5 percent angular sandstone cobbles; gradual wavy boundary.
Cr—35 inches; weathered interbedded sandstone and shale.

The mollic epipedon is 7 to 15 inches thick. Rock fragments are mainly channery fragments of sandstone and shale. Depth to bedrock ranges from 20 to 40 inches. Slightly calcareous spots are in the lower part of the B3 horizon and in the C1 horizon in some pedons. A thin O horizon is present in some areas under dense brush cover.

Irigul series

The Irigul series consists of shallow, well drained soils on ridges, hillcrests, and mountainsides. These soils formed in residuum derived from sandstone and hard shale. Slope is 5 to 50 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are loamy-skeletal, mixed Lithic Cryoborolls.

Typical pedon of Irigul channery loam, 5 to 50 percent slopes, 1,550 feet east and 600 feet south of the northwest corner of sec. 14, T. 4 S., R. 97 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) channery loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; 30 percent fine channery fragments; mildly alkaline; clear wavy boundary.
C1—5 to 12 inches; brown (10YR 5/3) extremely channery loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine pores; common very fine and fine vertically oriented roots between rock fragments; thin calcium carbonate coatings on the underside of channery fragments; mildly alkaline; abrupt wavy boundary.
R—12 inches; hard flaggy sandstone.

The mollic epipedon is 7 to 15 inches thick. Lithic contact is at a depth of 10 to 20 inches. The A horizon has hue of 2.5Y or 10YR, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3. The C horizon has hue of 2.5 to 7.5YR, value of 4 to 6 when dry and 3 or 4 when moist, and chroma of 2 to 4. The C horizon is slightly calcareous in some pedons.

Jerry series

The Jerry series consists of deep, well drained soils on mountainsides and ridges. These soils formed in residuum and colluvium derived mainly from shale. Slope is 5 to 45 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are fine, montmorillonitic Argic Cryoborolls.

Typical pedon of Jerry loam, 12 to 45 percent slopes, about 275 feet east and 1,000 feet south of the center of sec. 34, T. 2 N., R. 93 W.

A11—0 to 2 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate fine to medium granular structure; soft, very friable; scattered angular gravel and cobbles; neutral; abrupt smooth boundary.
A12—2 to 5 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure parting to moderate fine and medium granular; soft, very friable, nonsticky and slightly plastic; 5 percent angular gravel and cobbles; mildly alkaline; abrupt wavy boundary.
A3—5 to 13 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium to coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 10 percent angular gravel and cobbles; mildly alkaline; clear wavy boundary.
B2t—13 to 34 inches; yellowish brown (10YR 5/4, dry or moist) channery heavy clay loam; strong medium subangular blocky structure; hard, friable, sticky and plastic; few thin clay films on ped faces; 15 percent angular gravel and cobbles; weakly calcareous in lower part; neutral; gradual wavy boundary.
B3ca—34 to 48 inches; light olive brown (2.5Y 5/4, dry or moist) channery clay loam; weak medium and coarse subangular blocky structure; slightly hard, friable, sticky and plastic; 25 percent angular gravel

and cobbles; calcareous; mildly alkaline; clear wavy boundary.
Cca—48 to 60 inches; light yellowish brown (2.5Y 6/4) channery clay loam and weathered sandstone; massive; slightly hard to hard, friable; 25 percent angular gravel and cobbles; calcareous; moderately alkaline.

The mollic epipedon is 7 to 15 inches thick. Depth to calcareous material is 15 to 40 inches. The control section is 10 to 35 percent rock fragments, mainly gravel, throughout.

Kamack series

The Kamack series consists of deep, well drained soils on uplands and high mountainsides. These soils formed in colluvium and residuum derived mainly from sedimentary rock. Slopes are 15 to 60 percent. Average annual precipitation is about 20 to 25 inches, and average annual air temperature is 38 degrees F.

These soils are loamy-skeletal, mixed Typic Cryoborolls.

Typical pedon of a Kamack loam in an area of Lamphier-Tampico-Kamack loams, 5 to 60 percent slopes, about 2,250 feet north and 150 feet east of the southwest corner of sec. 8, T. 1 N., R. 91 W.

O1—1/2 inch to 0; decomposing leaves and twigs.
A1—0 to 14 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak fine and medium subangular blocky structure parting to moderate very fine and fine granular; slightly hard, very friable, slightly sticky and nonplastic; 5 percent channery fragments; neutral; clear smooth boundary.
B21—14 to 22 inches; light reddish brown (5YR 6/4) very gravelly loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 25 percent channery fragments and 10 percent cobbles; neutral; clear wavy boundary.
B22—22 to 32 inches; light reddish brown (5YR 6/4) very cobbly loam, reddish brown (5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 20 percent angular cobbles and 20 percent channery fragments; neutral; clear wavy boundary.
C1—32 to 55 inches; reddish brown (5YR 5/4) very cobbly loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 30 percent angular cobbles and 25 percent channery fragments; neutral; abrupt irregular boundary.
R—55 inches; hard sandstone.

The mollic epipedon is 7 to 15 inches thick. Depth to fractured bedrock ranges from 40 to 60 inches. The B horizon typically is very cobbly loam, but it ranges to very cobbly clay loam. In some pedons the part of the C horizon below a depth of about 36 inches is slightly calcareous in spots or has thin coatings of calcium carbonate on the underside of rock fragments. Many fine mica flecks are throughout the profile in some areas.

Killpack series

The Killpack series consists of moderately deep, well drained soils on toe slopes of low, rolling hills and on ridges. These soils formed in residuum and colluvium derived from calcareous, gypsiferous shale. Slope is 3 to 8 percent. Average annual precipitation is about 8 inches, and average annual air temperature is about 48 degrees F.

These soils are fine-silty, mixed (calcareous), mesic Typic Torriorthents.

Typical pedon of a Killpack silty clay loam in an area of Chipeta-Killpack silty clay loams, 3 to 15 percent slopes, 524 feet east and 200 feet north of the southwest corner of sec. 32, T. 2 N., R. 102 W.

A11—0 to 2 inches; light gray (2.5Y 6/2) light silty clay loam, grayish brown (2.5Y 5/2) moist; thick platy structure in upper part and moderate fine to coarse granular structure in lower part; soft, friable, sticky and slightly plastic; calcareous; moderately alkaline; abrupt smooth boundary.
A12—2 to 4 inches; light brownish gray (2.5Y 6/2) light silty clay loam, grayish brown (2.5Y 5/2) moist; moderate medium and coarse subangular blocky structure parting to strong fine subangular blocky; slightly hard, friable, sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.
C1cs—4 to 8 inches; light brownish gray (2.5Y 6/2) light silty clay loam, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine gypsum crystals; calcareous; moderately alkaline; clear smooth boundary.
C2cs—8 to 30 inches; grayish brown (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine to thick platy structure parting to moderate very fine and fine subangular blocky; hard, firm, sticky and plastic; 10 percent fine shale chips; very few fine gypsum crystals in thin seams; weakly calcareous in spots; mildly alkaline; abrupt irregular boundary.
Cr—30 inches; slightly weathered platy shale.

Depth to shale ranges from 20 to 40 inches. Hue is 5Y to 10YR throughout the profile. The content of gypsum in the profile is less than 15 percent.

Kinnear series

The Kinnear series consists of deep, well drained soils on uplands, fans, and terraces. These soils formed in mixed alluvial and eolian material. Slope is 1 to 5 percent. Average annual precipitation is about 10 inches, and average annual air temperature is about 48 degrees F.

These soils are fine-loamy, mixed, mesic Typic Camborthids.

Typical pedon of Kinnear fine sandy loam, 1 to 5 percent slopes, 1,400 feet south and 950 feet west of the northeast corner of sec. 9, T. 1 N., R. 102 W.

A1—0 to 5 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; thin platy structure in upper part and weak medium subangular blocky in lower part; soft, very friable, slightly sticky and nonplastic; calcareous; moderately alkaline; abrupt smooth boundary.

B2—5 to 12 inches; pale brown (10YR 6/3) loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

B3ca—12 to 17 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C1ca—17 to 35 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C2—35 to 60 inches; pale brown (10YR 6/3) light loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; calcareous; moderately alkaline.

Depth to uniformly calcareous material is 0 to 8 inches. The profile is 0 to 10 percent gravel. The solum is mildly alkaline or moderately alkaline.

The A horizon has hue of 5Y to 10YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

The B horizon commonly has many cicada cavities. The B2 horizon has hue of 2.5Y to 7.5YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 to 4.

The C horizon is 5 to 15 percent calcium carbonate. It has hue of 2.5Y to 7.5YR, value of 6 to 8 when dry and 4 to 6 when moist, and chroma of 2 to 4. It is moderately alkaline or strongly alkaline.

Kobar series

The Kobar series consists of deep, well drained soils on fans, valley side slopes, and alluvium valley floors. These soils formed in alluvium derived from shale. Slope is 0 to 15 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 43 degrees F.

These soils are fine, montmorillonitic Borollic Camborthids.

Typical pedon of Kobar silty clay loam, 0 to 3 percent slopes, about 1,625 feet east and 2,300 feet north of the southwest corner of sec. 18, T. 1 N., R. 93 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine crumb structure; slightly hard, friable, slightly sticky and plastic; calcareous; moderately alkaline; abrupt smooth boundary.

AC—3 to 12 inches; grayish brown (2.5Y 5/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

C1ca—12 to 28 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium to coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; common fine soft masses of calcium carbonate; calcareous; strongly alkaline; clear smooth boundary.

C2cacs—28 to 43 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; moderate medium and coarse angular blocky structure; very hard, firm, sticky and plastic; common medium soft masses and seams of calcium carbonate and common fine seams of gypsum; calcareous; strongly alkaline; gradual wavy boundary.

C3—43 to 60 inches; light gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; weak coarse angular and subangular blocky structure; very hard, firm, sticky and plastic; few fine soft masses and seams of calcium carbonate; calcareous; strongly alkaline.

The profile has scattered gravel, channery fragments, and shale chips throughout. In some pedons thin vertical cracks as much as 1/4 inch wide form in the control section as the soils dry. Discontinuous strata of coarse textured material 1/4 to 1 inch thick are in some pedons. They commonly are darker or lighter colored than the rest of the profile. Calcium carbonate occurs as thin seams or soft masses in the C1ca horizon and as medium soft masses, seams, or filaments in the C2cacs horizon. Gypsum occurs as fine concretions, seams, or

filaments. In some pedons pressure faces are on peds in the C1 horizon.

Lamphier series

The Lamphier series consists of deep, well drained soils on mountainsides and valley sides. These soils formed in alluvium and colluvium derived mainly from sandstone. Slope is 5 to 35 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are fine-loamy, mixed Pachic Cryoborolls.

Typical pedon of a Lamphier loam in an area of Rhone-Northwater-Lamphier loams, 3 to 50 percent slopes, about 400 feet east and 1,000 feet north of the center of sec. 14, T. 2 S., R. 92 W.

O1—2 inches to 0; decomposing leaves and twigs.
A11—0 to 4 inches; brown (7.5YR 4/2) loam, dark reddish brown (5YR 2/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky; neutral; clear smooth boundary.
A12—4 to 26 inches; brown (7.5YR 5/2) loam, dark reddish brown (5YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.
C1—26 to 42 inches; reddish brown (5YR 5/3) loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few channery fragments; neutral; clear wavy boundary.
C2—42 to 60 inches; reddish brown (2.5YR 5/4) loam, reddish brown (2.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 10 percent channery fragments; neutral.

The mollic epipedon is 16 to 30 inches thick and in some pedons contains scattered gravel. In some pedons some soft masses of lime are at a depth of more than 40 inches. The profile is 0 to 15 percent channery fragments that are mainly less than 3 inches long, but some are as much as 10 inches long. The C horizon ranges from loam to sandy clay loam.

Mergel series

The Mergel series consists of deep, well drained soils on hills and ridges. These soils formed in colluvium derived from sedimentary rock. Slope is 8 to 65 percent. Average annual precipitation is 18 inches, and average annual air temperature is about 40 degrees F.

These soils are loamy-skeletal, mixed Torriorthentic Haploborolls.

Typical pedon of a Mergel channery loam in an area of Mergel-Redthayne-Dollard complex, 8 to 65 percent slopes, about 2,290 feet south and 1,300 feet east of the northwest corner of sec. 32, T. 2 N., R. 93 W.

A1—0 to 9 inches; grayish brown (10YR 5/2) channery loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; 20 percent angular gravel and cobbles; mildly alkaline; clear wavy boundary.
AC—9 to 12 inches; light brownish gray (10YR 6/2) channery loam, dark grayish brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable, sticky and plastic; 20 percent angular gravel and cobbles; calcareous; moderately alkaline; clear wavy boundary.
C1ca—12 to 22 inches; pale brown (10YR 6/3) very channery light clay loam, brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, sticky and plastic; 30 percent angular channery fragments and 15 percent flagstones; coatings of calcium carbonate on underside of rock fragments; calcareous; moderately alkaline; clear wavy boundary.
C2ca—22 to 50 inches; light brownish gray (10YR 6/2) very channery heavy loam, brown (10YR 4/3) moist; weak to moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 30 percent channery fragments and 15 percent flagstones; coatings of calcium carbonate on underside of rock fragments; calcareous; moderately alkaline; clear wavy boundary.
C3—50 to 60 inches; brown (10YR 4/3) very channery light loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; 35 percent angular gravel and cobbles and 15 percent flagstones; calcareous; moderately alkaline.

The Cca horizon has faint to readily visible calcium carbonate in the fine earth fraction. The calcium carbonate occurs mainly as coatings on the underside of rock fragments. The C2 horizon, where present, is at a depth of more than 40 inches. Thin, discontinuous, highly weathered strata of coal 1 inch to 10 inches thick are in some pedons.

Midway series

The Midway series consists of shallow, well drained soils on the lower part of hillsides and on narrow ridges and knolls. These soils formed in calcareous residuum derived from shale. Slope is 2 to 25 percent. Average annual precipitation is about 12 inches, and average annual air temperature is about 48 degrees F.

These soils are clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of a Midway silty clay loam in an area of Gaynor-Midway silty clay loams, dry, 2 to 25 percent slopes, in the SE1/4SE1/4 of sec. 21, T. 1 N., R. 103 W.

A1—0 to 4 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak coarse platy structure parting to weak fine granular; slightly hard, very friable, sticky and plastic; calcareous; moderately alkaline; clear wavy boundary.
AC—4 to 9 inches; pale brown (10YR 6/3) silty clay loam, light olive brown (2.5Y 5/4) moist; massive; soft, very friable, sticky and plastic; calcareous; mildly alkaline; clear wavy boundary.
C1—9 to 13 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; many shale fragments; common fine white nests of gypsum; calcareous; moderately alkaline; abrupt wavy boundary.
Cr2—13 inches; highly weathered light gray (2.5Y 7/2) fissile shale, light brownish gray (2.5Y 6/2) moist; many coarse prominent yellow (2.5Y 8/8) bands and common medium distinct white (10YR 8/2) coatings; mildly alkaline in matrix but neutral in bands.

Depth to the Cr horizon ranges from 8 to 20 inches. The content of shale fragments above the Cr horizon ranges from less than 5 percent to 20 percent.

Miracle series

The Miracle series consists of moderately deep, well drained soils on mountainsides, hills, and ridges. These soils formed in colluvium and residuum derived from red-bed sandstone and shale. Slope is 3 to 25 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are fine-loamy, mixed Argic Cryoborolls.

Typical pedon of Miracle fine sandy loam, 3 to 25 percent slopes, about 690 feet east and 485 feet south of the northwest corner of sec. 23, T. 2 S., R. 92 W.

A11—0 to 8 inches; dark reddish gray (5YR 4/2) fine sandy loam, dark reddish brown (5YR 3/2) moist; weak to moderate fine and medium granular structure; soft, very friable, nonsticky and nonplastic; neutral; gradual smooth boundary.
A12—8 to 15 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak fine subangular and granular structure; soft, very friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.
B1—15 to 22 inches; reddish brown (5YR 4/3) loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent sandstone channery fragments; neutral; clear wavy boundary.
B2t—22 to 27 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (2.5YR 4/4) moist; moderate to strong medium subangular blocky structure; hard, firm, sticky and plastic; few thin clay films on ped faces; 5 percent sandstone channery fragments; neutral; clear wavy boundary.
Cr—27 to 32 inches; reddish brown (5YR 5/3) weathered fractured sandstone; abrupt irregular boundary.
R—32 inches; reddish brown hard sandstone.

Bedrock is at a depth of 20 to 40 inches. The profile generally is noncalcareous throughout, but it is discontinuous and slightly calcareous above the bedrock in some pedons. The profile is 0 to 15 percent rock fragments. The mollic epipedon is 8 to 15 inches thick. The B horizon is heavy loam or sandy clay loam.

Moyerson series

The Moyerson series consists of shallow, well drained soils on ridges and side slopes of dissected plateaus. These soils formed in residuum derived from shale. Slope is 15 to 65 percent. Average annual precipitation is about 14 inches, and average annual air temperature is about 43 degrees F.

These soils are clayey, montmorillonitic (calcareous), frigid, shallow Ustic Torriorthents.

Typical pedon of Moyerson stony clay loam, 15 to 65 percent slopes, 0.1 mile west of the road in the NE1/4NW1/4 of sec. 30, T. 1 N., R. 101 W.

A1—0 to 2 inches; light gray (10YR 6/1) stony clay loam, dark gray (10YR 4/1) moist; moderate coarse platy structure parting to moderate fine granular; slightly hard, friable, sticky and slightly plastic; 15 percent stones; calcareous; moderately alkaline; clear wavy boundary.
AC—2 to 10 inches; light gray (10YR 6/1) heavy clay loam, dark gray (10YR 4/1) moist; moderate coarse subangular blocky structure; very hard, friable, sticky and very plastic; calcareous; moderately alkaline; clear wavy boundary.
C1—10 to 17 inches; light gray (10YR 6/1) clay, dark gray (10YR 4/1) moist; moderate coarse subangular blocky structure; very hard, firm, sticky and very plastic; calcareous; strongly alkaline; clear wavy boundary.
Cr—17 inches; light gray (10YR 6/1) highly fractured calcareous shale.

In places 5 to 15 percent of the surface is covered with boulders, flagstones, or stones. Paralithic contact is at a depth of 10 to 20 inches. Depth to uniformly calcareous material ranges from 0 to 3 inches. The profile is moderately alkaline or strongly alkaline. It is as much as 10 percent calcium carbonate equivalent.

Nagitsy series

The Nagitsy series consists of moderately deep, well drained soils on mountains and ridges. These soils

formed in residuum and colluvium derived from sandstone and shale. Slope is 5 to 50 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 38 degrees F.

These soils are loamy-skeletal, mixed Pachic Cryoborolls.

Typical pedon of a Nagitsy channery loam in an area of Nagitsy-Irigul channery loams, 5 to 50 percent slopes, about 150 feet west of the south quarter corner of sec. 2, T. 1 S., R. 92 W.

A11—0 to 7 inches; very dark grayish brown (10YR 3/2) channery loam, very dark brown (10YR 2/2) moist; weak fine and medium subangular blocky structure parting to moderate fine and medium granular; soft, very friable, slightly sticky and slightly plastic; 20 percent sandstone channery fragments; medium acid; clear smooth boundary.

A12—7 to 23 inches; dark grayish brown (10YR 4/2) channery loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 30 percent sandstone channery fragments; medium acid; clear wavy boundary.

B2—23 to 33 inches; brown (10YR 4/3) very channery loam, dark brown (10YR 3/3) moist; weak coarse subangular blocky structure; slightly sticky and slightly plastic; 60 percent channery fragments and 15 percent stones; slightly acid; gradual wavy boundary.

R—33 inches; hard sandstone.

Organic surface litter 0 to 2 inches thick is in areas under dense brush. Depth to bedrock ranges from 20 to 40 inches. Rock fragments make up 15 to 35 percent of the A horizon and 35 to 65 percent of the control section. The profile is neutral to medium acid. The A horizon is dark grayish brown to very dark brown. Clay content of the fine earth fraction is 15 to 27 percent.

Nihill series

The Nihill series consists of deep, somewhat excessively drained soils on toe slopes and terrace edges. These soils formed in colluvium derived mainly from sandstone. Slope is 5 to 50 percent. Average annual precipitation is about 11 inches, and average annual air temperature is about 48 degrees F.

These soils are loamy-skeletal, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of Nihill channery sandy loam, 5 to 50 percent slopes, west of Hefley Ranch, 650 feet west and 275 feet south of the northeast corner of sec. 34, T. 2 N., R. 101 W.

A1—0 to 5 inches; brown (10YR 5/3) channery sandy loam, brown (10YR 4/3) moist; weak medium and coarse granular structure; soft, very friable, nonsticky and nonplastic; 15 percent channery fragments and 5 percent flagstones; calcareous; moderately alkaline; clear smooth boundary.

C1—5 to 15 inches; pale brown (10YR 6/3) channery loam, brown (10YR 4/3) moist; weak to moderate fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; 30 percent channery fragments and 5 percent flagstones; calcareous; moderately alkaline; clear wavy boundary.

C2ca—15 to 23 inches; pale brown (10YR 6/3) very channery loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; 40 percent channery fragments and 10 percent flagstones; few fine soft masses of lime; calcareous; moderately alkaline; clear wavy boundary.

C3ca—23 to 38 inches; pale brown (10YR 6/3) very channery sandy loam, brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; 40 percent channery fragments and 10 percent flagstones; few medium soft masses of lime; calcareous; strongly alkaline; clear wavy boundary.

C4ca—38 to 60 inches; pale brown (10YR 6/3) very channery sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; 55 percent channery fragments and 10 percent flagstones; disseminated lime; calcareous; moderately alkaline.

The profile is 35 to 45 percent channery fragments and 10 to 15 percent flagstones. The A horizon is 20 to 35 percent channery fragments and about 5 percent flagstones. Most rock fragments in the C horizon have thin coatings of calcium carbonate on the undersides.

Northwater series

The Northwater series consists of deep, well drained soils on mountainsides. These soils formed in residuum and colluvium derived from sandstone and hard shale. Slope is 5 to 50 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are loamy-skeletal, mixed Cryic Pachic Paleborolls.

Typical pedon of Northwater loam, 5 to 50 percent slopes, about 1,280 feet west of the trail in the West Fork of Story Gulch, in the NW1/4SW1/4 of sec. 18, T. 4 S., R. 95 W.

O2—2 inches to 0; organic mat of leaves and twigs.

A11—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

A12—4 to 20 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak

medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and nonplastic; 5 percent channery fragments; neutral; clear wavy boundary.

B1—20 to 25 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; 10 percent channery fragments 3/4 inch to 3 inches long and few flagstones as much as 10 inches long; neutral; gradual smooth boundary.

B2t—25 to 41 inches; pale brown (10YR 6/3) very channery sandy clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure parting to moderate fine subangular blocky; hard, friable, sticky and plastic; 50 percent channery fragments 3/4 inch to 3 inches long and few flagstones as much as 10 inches long; neutral; clear smooth boundary.

C—41 to 47 inches; light yellowish brown (10YR 6/4) very channery light loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; 70 percent channery fragments and flagstones; neutral; clear wavy boundary.

R—47 inches; fractured sandstone.

Depth to bedrock is 40 to 60 inches. The mollic epipedon is 20 to 40 inches thick. Depth to the argillic horizon is 24 inches or more. The profile is neutral or mildly alkaline.

The A horizon has hue of 7.5YR to 2.5Y, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3. It commonly is less than 15 percent rock fragments. The B horizon has a hue of 7.5YR to 2.5Y, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 3 or 4. It is 35 to 65 percent rock fragments that dominantly are 3/4 inch to 3 inches across and are thin and flat. The C horizon, where present, has hue of 7.5YR to 2.5Y and is as much as 85 percent rock fragments.

Owen Creek series

The Owen Creek series consists of moderately deep, well drained soils on hillcrests, ridges, and mountainsides. These soils formed in residuum derived from interbedded shale and sandstone. Slope is 5 to 20 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are fine, montmorillonitic Argic Cryoborolls.

Typical pedon of an Owen Creek loam in an area of Owen Creek-Jerry-Burnette loams, 5 to 35 percent slopes, 2,150 feet south and 1,850 feet west of the northeast corner of sec. 20, T. 3 N., R. 93 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B1—5 to 9 inches; grayish brown (10YR 5/2) clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, friable, sticky and plastic; neutral; clear smooth boundary.

B2t—9 to 24 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to strong angular blocky; extremely hard, firm, sticky and plastic; thin nearly continuous clay films and occasional slickensides on peds; mildly alkaline; clear wavy boundary.

C2r—24 inches; highly weathered calcareous variegated shale interbedded with thin strata of sandstone; some visible soft concretions and coatings of secondary calcium carbonate.

The mollic epipedon is 6 to 12 inches thick. Depth to calcareous material ranges from 15 to 36 inches. Content of channery fragments in the profile ranges from 0 to 10 percent. Some pedons have discontinuous thin strata of highly weathered, coallike organic material.

The A horizon has hue of 2.5Y to 7.5YR, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 1 to 3. It is neutral or mildly alkaline. The B2t horizon has hue of 2.5Y to 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 2 or 3. It generally is mildly alkaline and is heavy clay loam or clay. The Cca horizon has value of 6 or 7 when dry and 5 to 7 when moist. It is clay loam or clay and contains as much as 15 percent fine shale or sandstone chips.

Parachute series

The Parachute series consists of moderately deep, well drained soils on ridges and mountainsides. These soils formed in residuum derived from sandstone or hard shale. Slope is 5 to 75 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are loamy-skeletal, mixed Typic Cryoborolls.

Typical pedon of Parachute loam, 25 to 75 percent slopes, on Dead Horse Ridge in the NW1/4NE1/4 of sec. 36, T. 1 S., R. 100 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; neutral; clear smooth boundary.

B21—4 to 14 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable,

slightly sticky and slightly plastic; 10 to 15 percent fine channery fragments; neutral; clear smooth boundary.

B22—14 to 24 inches; grayish brown (10YR 5/2) channery loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 30 percent fine channery fragments; mildly alkaline; clear smooth boundary.

B3—24 to 32 inches; pale brown (10YR 6/3) very channery loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and nonplastic; 40 percent fine channery fragments; mildly alkaline; clear wavy boundary.

C1—32 to 38 inches; very pale brown (10YR 7/4) extremely channery sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; 70 percent channery fragments 1/2 inch to 2 inches long; mildly alkaline; abrupt irregular boundary.

R—38 inches; fractured sandstone.

The mollic epipedon is 10 to 15 inches thick. Depth to the lithic contact ranges from 20 to 40 inches. The profile is neutral or mildly alkaline. It is 18 to 25 percent clay.

The A1 and B2 horizons have hue of 7.5YR to 2.5Y, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3. The B3 and C horizons, where present, have hue of 7.5YR to 2.5Y, value of 6 or 7 when dry and 4 or 5 when moist, and chroma of 3 or 4.

The C horizon is 35 to 85 percent rock fragments, mainly 3/4 inch to 3 inches in diameter.

Patent series

The Patent series consists of deep, well drained soils on fans, terraces, and toe slopes. These soils formed in calcareous alluvial, colluvial, and eolian material derived dominantly from sandstone. Slope is 0 to 25 percent. Average annual precipitation is about 15 inches, and average annual air temperature is about 43 degrees F.

These soils are fine-loamy, mixed (calcareous), frigid Ustic Torriorthents.

Typical pedon of Patent loam, 0 to 3 percent slopes, about 810 feet east and 775 feet north of the west quarter corner of sec. 29, T. 1 N., R. 94 W.

A1—0 to 3 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak coarse platy structure parting to moderate medium subangular blocky; soft, very friable, slightly sticky and slightly plastic; calcareous; mildly alkaline; clear smooth boundary.

AC—3 to 10 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.

C1—10 to 24 inches; very pale brown (10YR 8/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; disseminated calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C2—24 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and nonplastic; soft masses of lime; calcareous; moderately alkaline.

In some pedons a few fine concretions and crystals of gypsum are in the C horizon. In some pedons the profile is as much as 15 percent rock fragments. The A horizon has hue of 10YR or 2.5Y, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 2 or 3 when dry or moist. The C horizon has hue of 10YR or 2.5Y.

Perma series

The Perma series consists of deep, well drained soils on mountains and uplands. These soils formed in material derived from basaltic alluvium and colluvium. Slope is 15 to 65 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 40 degrees F.

These soils are loamy-skeletal, mixed Typic Haploborolls.

Typical pedon of a Perma cobbly loam in an area of Delson-Perma complex, 3 to 65 percent slopes, in the SE1/4 of sec. 35, T. 1 N., R. 91 W.

A1—0 to 8 inches; brown (7.5YR 4/2) cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, very friable, sticky and slightly plastic; 20 percent cobbles and some gravel; neutral; clear wavy boundary.

B1—8 to 15 inches; brown (10YR 4/3) very cobbly heavy loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, sticky and slightly plastic; 25 percent cobbles and 25 percent gravel; neutral; clear wavy boundary.

B2—15 to 30 inches; grayish brown (10YR 5/2) very cobbly loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, sticky and slightly plastic; 30 percent cobbles and 25 percent gravel; neutral; clear wavy boundary.

C1—30 to 60 inches; grayish brown (10YR 5/2) very cobbly sandy loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; 30 percent cobbles and 30 percent gravel; neutral.

Small pockets of calcareous material are below a depth of 40 inches in some pedons. The profile is 35 to 70 percent coarse fragments. It is neutral or mildly

alkaline. The A1 horizon has hue of 7.5YR to 2.5Y, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 . The B horizon has value of 5 to 7 when dry and 3 to 5 when moist, and it has chroma of 2 or 3. The C horizon has value of 5 to 7 when dry and 4 to 6 when moist, and it has chroma of 2 or 3. It is very cobbly loam to very cobbly sandy loam.

Piceance series

The Piceance series consists of moderately deep, well drained soils on uplands and broad ridgetops. These soils formed in eolian material and colluvium derived dominantly from sandstone. Slope is 2 to 15 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 43 degrees F.

These soils are fine-loamy, mixed Borollic Camborthids.

Typical pedon of Piceance fine sandy loam, 5 to 15 percent slopes, 2,100 feet east and 1,650 feet south of the northwest corner of sec. 10, T. 2 S., R. 99 W.

A1—0 to 4 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; few fine channery fragments; mildly alkaline; clear smooth boundary.

B1—4 to 9 inches; brown (10YR 5/3) light loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 5 percent fine channery fragments; mildly alkaline; clear wavy boundary.

B2—9 to 22 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 10 percent channery fragments; calcareous in lower part; mildly alkaline; clear wavy boundary.

C1ca—22 to 30 inches; very pale brown (10YR 7/3) channery light loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 35 percent channery fragments; visible calcium carbonate in thin seams and soft masses; calcareous; moderately alkaline; clear wavy boundary.

R—30 inches; hard fine-grained sandstone.

From 0 to 5 percent of the surface is covered with fine channery fragments. Depth to calcareous material ranges from 2 to 24 inches. Depth to lithic contact ranges from 20 to 40 inches. The A and B horizons are 0 to 10 percent fine channery fragments.

The A horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4.

The B horizon has hue of 10YR or 7.5YR, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 3 to 6. It is loam, clay loam, or sandy clay loam that is as much as 18 to 30 percent clay.

The C horizon has hue of 2.5Y to 7.5YR. It is 25 to 35 percent channery fragments. The fine earth fraction is sandy loam, loam, or sandy clay loam.

Pinelli series

The Pinelli series consists of deep, well drained soils on alluvial fans and terraces along intermittent drainageways. These soils formed in alluvium derived dominantly from shale. Slope is 3 to 12 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 43 degrees F.

These soils are fine, montmorillonitic Borollic Haplargids.

Typical pedon of Pinelli clay loam, 3 to 12 percent slopes, about 6 miles east and 12 miles north of Meeker; about 750 feet south and 200 feet west of the northeast corner of the NE1/4NE1/4 of sec. 23, T. 3 N., R. 92 W.

A1—0 to 3 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine platy structure; hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

B21t—3 to 13 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate or strong medium angular blocky; very hard, friable, sticky and plastic; mildly alkaline; clear wavy boundary.

B22t—13 to 26 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium angular blocky; very hard, friable, very sticky and very plastic; calcareous; moderately alkaline; clear wavy boundary.

B3ca—26 to 31 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; moderate medium angular blocky structure; very hard, friable, sticky and slightly plastic; many small threads of lime; calcareous; moderately alkaline; clear wavy boundary.

Cca—31 to 60 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; very hard, friable, sticky and slightly plastic; many small threads of lime; calcareous; moderately alkaline.

Depth to lime ranges from 10 to 22 inches. The argillic horizon is 35 to 40 percent clay. It is silty clay loam or clay loam. The profile is 0 to 5 percent rock fragments throughout. The A and B horizons have hue of 2.5Y to 10YR, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 2 or 3.

Potts series

The Potts series consists of deep, well drained soils on broad alluvial fans and uplands. These soils formed in eolian and alluviual material derived dominantly from sandstone. Slope is 2 to 7 percent. Average annual precipitation is about 12 inches, and average annual air temperature is about 48 degrees F.

These soils are fine-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of a Potts fine sandy loam in an area of Potts-Begay fine sandy loams, 2 to 7 percent slopes, about 5 miles south-southwest of Dinosaur and 0.35 mile east of Utah state line; 100 feet south of trail in the NW1/4NW1/4 of sec. 2, T. 2 N., R. 104 W.

A1—0 to 3 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; moderately alkaline; clear wavy boundary.

B21t—3 to 7 inches; brown (7.5YR 5/4) heavy loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately alkaline; clear wavy boundary.

B22t—7 to 14 inches; brown (7.5YR 5/4) heavy loam, brown (7.5YR 4/4) moist; strong medium angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; moderately alkaline; abrupt wavy boundary.

B3ca—14 to 17 inches; light brown (7.5YR 6/4) heavy loam, brown (7.5YR 5/4) moist; weak coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

C1ca—17 to 35 inches; pink (7.5YR 7/4) loam, light yellowish white (10YR 6/4) moist; few fine white (10YR 8/2) streaks and soft masses of lime; massive; very hard, friable; calcareous; alkaline; gradual wavy boundary.

C2ca—35 to 50 inches; pink (7.5YR 7/4) loam, very pale brown (10YR 7/4) moist; massive; slightly hard, very friable; calcareous; strongly alkaline; gradual smooth boundary.

C3—50 to 60 inches; pink (7.5YR 7/4) loam, light brown (7.5YR 6/4) moist; massive; slightly hard, very friable; calcareous; strongly alkaline.

Calcareous material is at a depth of 0 to 15 inches. The solum is 12 to 20 inches thick. It is 0 to 5 percent rock fragments.

The A horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 3 or 4 when moist. It is mildly alkaline or moderately alkaline.

The B2t horizon has value of 5 or 6 when dry and 4 or 5 when moist.

The Cca horizon has value of 7 or 8 when dry and 6 or 7 when moist. The Cca horizon is 18 to 35 inches thick. It is light clay loam or loam. The upper part is hard or very hard when dry. It is moderately alkaline or strongly alkaline and has 5 to 10 percent calcium carbonate equivalent. The lower part is slightly hard or soft when dry. It has 8 to 14 percent calcium carbonate equivalent.

Rabbitex series

The Rabbitex series consists of deep, well drained soils on north-facing mountainsides. These soils formed in colluvium and residuum derived dominantly from sandstone. Slope is 10 to 65 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 40 degrees.

These soils are fine-loamy, mixed Typic Calciborolls.

Typical pedon of Rabbitex flaggy loam, 10 to 65 percent slopes, 1,540 feet south and 20 feet east of the northwest corner of sec. 8, T. 3 S., R. 102 W.

A1—0 to 12 inches; brown (10YR 5/3) flaggy loam, dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, nonsticky and nonplastic; 5 percent fine channery fragments; calcareous; moderately alkaline; clear wavy boundary.

AC—12 to 21 inches; pale brown (10YR 6/3) channery loam, brown (10YR 4/3) moist; weak medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 15 percent channery fragments; calcareous; moderately alkaline; clear wavy boundary.

C1ca—21 to 43 inches; white (10YR 8/2) channery loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; disseminated lime and soft masses of lime; 20 percent channery fragments; calcareous; moderately alkaline; clear wavy boundary.

Cr—43 inches; very pale brown (10YR 7/3) and white (10YR 8/2) sandstone, light yellowish brown (10YR 6/4) moist; massive; very hard; calcareous; strongly alkaline.

From 0.1 to 2.0 percent of the surface is covered by flagstones and stones. Depth to bedrock ranges from 40 to 60 inches. The mollic epipedon is 6 to 14 inches thick. Depth to the calcic horizon is 10 to 28 inches. The 10- to 40-inch control section averages 18 to 25 percent clay and 10 to 30 percent channery fragments.

The A horizon is loam or flaggy loam. It is 5 to 20 percent rock fragments, mainly small, thin, flat pieces of marlstone and sandstone.

The Cca horizon has hue of 10YR or 2.5Y, value of 7 or 8 when dry and 6 or 7 when moist, and chroma of 2 to 4. It is 10 to 30 percent rock fragments. The calcium carbonate equivalent is 15 to 25 percent.

Razorba series

The Razorba series consists of deep, well drained soils on mountainsides. These soils formed in residuum and colluvium derived from sandstone. Slope is 30 to 75 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are coarse-loamy, mixed Pachic Cryoborolls.

Typical pedon of Razorba channery sandy loam, 30 to 75 percent slopes, about 1,900 feet west and 140 feet north of the SW1/4SE1/4 of sec. 21, T. 3 S., R. 102 W.

O—1 inch to 0; litter of leaves, twigs, and bark in various stages of decomposition.
A11—0 to 9 inches; dark grayish brown (10YR 4/2) channery sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; about 20 percent channery fragments; calcareous; moderately alkaline; clear wavy boundary.
A12—9 to 20 inches; dark grayish brown (10YR 4/2) channery sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; about 30 percent channery fragments; calcareous; moderately alkaline; clear wavy boundary.
A13—20 to 35 inches; dark grayish brown (10YR 4/2) channery sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; about 30 percent channery fragments; calcareous; moderately alkaline; clear wavy boundary.
C1—35 to 60 inches; grayish brown (10YR 5/2) channery sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; about 25 percent channery fragments; calcareous; moderately alkaline.

The mollic epipedon is 16 to 40 inches thick. The A horizon has value of 4 or 5 when dry, and it has chroma of 2 or 3. The average content of coarse fragments, mostly channery fragments, ranges from 15 to 25 percent. The C horizon has value of 5 to 8 when dry, and it has chroma of 2 or 3. It is channery sandy loam or very channery sandy loam.

Redcreek series

The Redcreek series consists of shallow, well drained soils on mountainsides and ridges. These soils formed in sandy eolian and residual material derived from calcareous sandstone. Slope is 5 to 30 percent. Average annual precipitation is about 15 inches, and average annual air temperature is about 43 degrees F.

These soils are loamy, mixed (calcareous), frigid Lithic Ustic Torriorthents.

Typical pedon of a Redcreek sandy loam in an area of Redcreek-Rentsac complex, 5 to 30 percent slopes, about 900 feet north of the southwest corner of sec. 18, T. 3 S., R. 96 W.

A1—0 to 4 inches; brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; soft, very friable, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.
AC—4 to 11 inches; brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 4/2) moist; weak medium subangular blocky structure parting to fine granular; soft, friable, nonsticky and nonplastic; calcareous; moderately alkaline; clear wavy boundary.
C1—11 to 16 inches; very pale brown (10YR 7/3) channery sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; calcareous; moderately alkaline; clear wavy boundary.
R—16 inches; hard sandstone.

Depth to sandstone ranges from 10 to 20 inches. The A horizon has hue of 10YR or 7.5YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 2 to 4. The C horizon has value of 6 or 7 when dry and 5 or 6 when moist, and it has chroma of 3 or 4.

Redrob series

The Redrob series consists of deep, somewhat poorly drained soils on alluvial valley floors, low terraces, and flood plains along major streams. These soils formed in mixed alluvium. Slope is 0 to 3 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 40 degrees F.

These soils are fine-loamy over sandy or sandy-skeletal, mixed (calcareous), frigid Fluvaquentic Haplaquolls.

Typical pedon of Redrob loam, 150 feet south and 730 feet east of the northwest corner of sec. 29, T. 1 N., R. 93 W.

A11—0 to 4 inches; grayish brown (10YR 5/2) light loam, dark brown (10YR 3/3) moist; weak coarse platy structure parting to moderate fine subangular blocky; slightly hard, very friable, slightly sticky; mildly alkaline; abrupt smooth boundary.
A12—4 to 17 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.
AC—17 to 35 inches; grayish brown (10YR 5/2) stratified loam, sandy loam, and loamy sand, dark grayish brown (10YR 4/2) moist; faint variegated very dark gray (10YR 3/1, moist) and dark brown (10YR 3/3, moist) lenses; common fine and medium distinct strong brown (7.5YR 5/6, moist) and yellowish

brown (10YR 5/6, moist) mottles; massive; slightly hard to soft, very friable; mildly alkaline; gradual smooth boundary.

IIC1g—35 to 60 inches; brown (10YR 4/3) very gravelly loamy sand and sand, dark grayish brown (10YR 4/2) moist; few medium distinct strong brown (7.5YR 5/6, moist) and yellowish brown (10YR 5/6, moist) mottles; 40 percent coarse fragments; neutral.

The water table generally is at a depth of 18 to 48 inches. The A horizon is calcareous in places. It has hue of 2.5Y to 7.5YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 2 or 3 when dry or moist. Wormcasts are common in some areas. Mottles are few to many, fine to large, and distinct or prominent. Depth to the IIC1g horizon ranges from 20 to 40 inches.

Redrob Variant

The Redrob Variant consists of deep, somewhat poorly drained soils on alluvial valley floors, flood plains, and low terraces. These soils formed in mixed alluvium. Slope is 0 to 3 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 38 degrees F.

These soils are fine-loamy over sandy or sandy-skeletal, mixed Typic Cryaquolls.

Typical pedon of Redrob Variant loam, 4.5 miles east of Buford, in the SE1/4SW1/4 of sec. 25, T. 1 N., R. 91 W.

A1—0 to 3 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate fine subangular blocky structure parting to moderate fine and very fine granular; soft, very friable, sticky and plastic; slightly acid; clear smooth boundary.

B2—3 to 15 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; strong very fine subangular blocky structure parting to strong very fine granular; slightly hard, very friable, sticky and plastic; many wormholes; neutral; clear wavy boundary.

IIC1—15 to 26 inches; grayish brown (2.5Y 5/2) very gravelly loamy sand, dark grayish brown (2.5Y 4/2) moist; common prominent yellowish brown (10YR 5/8) and brownish yellow (10YR 6/6) mottles; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 40 percent gravel; neutral; clear wavy boundary.

IIC2—26 to 60 inches; brown (10YR 5/3) very gravelly sand, dark brown (10YR 4/3) moist; 60 percent gravel and 15 percent cobbles; neutral.

The water table is between depths of 24 and 48 inches throughout the year. The mollic epipedon is 7 to 15 inches thick. Distinct or prominent mottles are in the lower part of the A horizon and in the B2 horizon.

The A horizon has value of 2 to 4 when dry and 2 or 3 when moist, and it has chroma of 1 or 2.

The B horizon has hue of 5Y to 7.2YR, value of 2 to 5 when dry and 2 to 4 when moist, and chroma of 1 to 3 when dry or moist. The B2 horizon is 18 to 27 percent clay. Few mottles are in the lower part of the horizon in some pedons.

The C horizon is more than 35 percent gravel and cobbles. The less sandy and gravelly layers are less than 10 inches thick.

Redthayne series

The Redthayne series consists of deep, well drained soils on mountainsides and toe slopes. These soils formed in colluvium derived dominantly from sandstone. Slope is 8 to 65 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 40 degrees F.

These soils are loamy-skeletal, mixed Aridic Haploborolls.

Typical pedon of a Redthayne channery loam in an area of Mergel-Redthayne-Dollard complex, 8 to 65 percent slopes, 850 feet north and 400 feet east of the center of sec. 30, T. 2 N., R. 92 W.

A1—0 to 8 inches; brown (7.5YR 5/2) channery loam, dark brown (7.5YR 3/2) moist; moderate fine and medium subangular blocky structure parting to moderate fine and medium granular; slightly hard, very friable, slightly sticky and nonplastic; 20 percent fine channery fragments; mildly alkaline; clear wavy boundary.

B2—8 to 18 inches; light brown (7.5YR 6/4) very channery loam, brown (7.5YR 4/4) moist; weak or moderate medium and coarse subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; 45 percent channery fragments and angular cobbles; calcareous; moderately alkaline; clear wavy boundary.

Cca—18 to 60 inches; light brown (7.5YR 6/4) very channery loam, reddish brown (5YR 4/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 40 percent channery fragments and 10 percent angular cobbles; few fine soft masses and seams of calcium carbonate; calcareous; strongly alkaline.

The texture of the B horizon ranges from loam to light clay loam. The B horizon contains 35 to 60 percent coarse fragments. The strongly contrasting material in the pedon or bedrock is commonly at a depth of 60 to 72 inches.

Rentsac series

The Rentsac series consists of shallow, well drained soils on foothills, ridges, and side slopes. These soils formed in residuum derived from sandstone. Slope is 5 to 50 percent. Average annual precipitation is about 15 inches, and average annual air temperature is about 43 degrees F.

These soils are loamy-skeletal, mixed (calcareous), frigid Lithic Ustic Torriorthents.

Typical pedon of Rentsac channery loam, 5 to 50 percent slopes, in the NE1/4NE1/4 of sec. 10, T. 2 S., R. 99 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) channery loam, brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable, nonsticky and nonplastic; 25 percent sandstone channery fragments; calcareous; moderately alkaline; clear smooth boundary.

AC—5 to 9 inches; brown (10YR 5/3) very channery light loam, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; 50 percent sandstone channery fragments and 10 percent flagstones; calcareous; moderately alkaline; gradual smooth boundary.

C1—9 to 16 inches; very pale brown (10YR 7/3) extremely flaggy light loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, nonsticky and nonplastic; 80 percent sandstone channery fragments and flagstones 2 to 10 inches in diameter and 1 to 2 inches thick; calcareous; moderately alkaline; clear wavy boundary.

R—16 inches; hard sandstone.

Depth to bedrock ranges from 10 to 20 inches. The A horizon is 20 to 35 percent rock fragments, most of which are less than 3 inches across. In some pedons the AC and C1 horizons have thin coatings of calcium carbonate on the underside of and along cracks in the rock fragments.

Rhone series

The Rhone series consists of deep, well drained soils on mountainsides, upland ridges, and side slopes. These soils formed in residuum and colluvium derived from sandstone and hard shale. Slope is 3 to 75 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are fine-loamy, mixed Pachic Cryoborolls.

Typical pedon of Rhone loam, 30 to 75 percent slopes, 1,850 feet north and 1,300 feet west of the southeast corner of sec. 16, T. 4 S., R. 95 W.

A11—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium and coarse granular structure; soft, very friable, nonsticky and slightly plastic; neutral; clear smooth boundary.

A12—8 to 24 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

A13—24 to 40 inches; grayish brown (10YR 5/2) very channery loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 35 to 45 percent fine channery fragments; neutral; clear wavy boundary.

C1—40 to 50 inches; brown (10YR 5/3) very channery loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 40 to 75 percent channery fragments; neutral; clear wavy boundary.

R—50 inches; fractured sandstone.

Depth to bedrock is 40 to 60 inches. The profile is neutral or mildly alkaline. The mollic epipedon is more than 16 inches thick. The A horizon has hue of 10YR or 7.5YR, value of 3 to 5 when dry and 2 or 3 when moist, and chroma of 2 or 3. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6 when dry and 4 or 5 when moist, and chroma of 2 to 4. It is 35 to 65 percent rock fragments.

Shawa series

The Shawa series consists of deep, well drained to somewhat poorly drained soils on alluvial valley floors, fans, and low terraces and along concave drainageways. These soils formed in mixed alluvium. Slope is 0 to 8 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 40 degrees F.

These soils are fine-loamy, mixed Pachic Haploborolls.

Typical pedon of Shawa loam, 1 to 3 percent slopes, 0.35 mile east and 300 feet north of the southwest corner of sec. 22, T. 1 N., R. 94 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A12—9 to 16 inches; grayish brown (10YR 5/2) light clay loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

AC—16 to 44 inches; brown (10YR 5/3) light clay loam, dark brown (10YR 3/3) moist; massive; slightly hard,

friable, slightly sticky and slightly plastic; calcareous; mildly alkaline; clear smooth boundary.

C1ca—44 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; massive; slightly hard, slightly sticky and slightly plastic; soft masses, thin seams, and streaks of secondary calcium carbonate; calcareous; moderately alkaline.

Depth to secondary lime is 40 to 60 inches or more. The control section is loam or clay loam and is 18 to 30 percent clay. The mollic epipedon is 20 to 60 inches thick or more. In some pedons a seasonal high water table is at a depth of 24 to 48 inches.

Silas series

The Silas series consists of deep, well drained soils on mountain valley bottoms and side slopes. These soils formed in mixed alluvium. Slope is 0 to 12 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 38 degrees F.

These soils are fine-loamy, mixed Cumulic Cryoborolls.

Typical pedon of Silas loam, 0 to 8 percent slopes, 0.4 mile from the head of Harrison Gulch, in the SE1/4SE1/4 of sec. 12, T. 4 S., R. 96 W.

A11—0 to 4 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak medium granular structure; soft, very friable, nonsticky and nonplastic; neutral; clear smooth boundary.

A12—4 to 10 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; neutral; abrupt smooth boundary.

A13—10 to 24 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; soft, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

C1—24 to 40 inches; dark gray (10YR 4/1) light loam, very dark gray (10YR 3/1) moist; massive; soft, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

C2—40 to 68 inches; dark gray (10YR 4/1) light sandy clay loam, very dark gray (10YR 3/1) moist; massive; hard, firm, sticky and plastic; neutral.

The profile is 5 to 15 percent fine channery fragments. It is neutral or mildly alkaline throughout. The 10- to 40-inch control section averages 18 to 35 percent clay. The A horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 1 or 2 when moist or dry. The C horizon has value of 2 or 3 when moist and 4 or 5 when dry, and it has chroma of 1 or 2 when moist or dry. It is light loam to light sandy clay loam.

Silas Variant

The Silas Variant consists of deep, moderately well drained soils on alluvial valley floors and fans and in swales on terraces. These soils formed in mixed alluvium. Slope is 1 to 3 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 40 degrees F.

These soils are fine-loamy, mixed Cumulic Haploborolls.

Typical pedon of Silas Variant loam in a pasture on the south side of Fourteen Mile Creek; about 2,080 feet south and 1,180 feet west of the northeast corner of sec. 8, T. 3 S., R. 94 W.

A11—0 to 6 inches; grayish brown (2.5Y 5/2) heavy loam, very dark gray (10YR 3/1) moist, very dark grayish brown (2.5Y 3/2) moist and rubbed; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; mildly alkaline; clear wavy boundary.

A12—6 to 20 inches; grayish brown (2.5Y 5/2) heavy loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; calcareous; mildly alkaline; clear wavy boundary.

C1—20 to 33 inches; grayish brown (10YR 5/2) loam, dark grayish brown (2.5Y 4/2) moist and rubbed; common distinct white (10YR 8/1) mottles, few fine distinct very dark gray (10YR 3/1) mottles, and few fine faint brown (10YR 5/3) mottles; massive; hard, friable, slightly sticky and slightly plastic; calcareous; mildly alkaline; abrupt wavy boundary.

B2b—33 to 49 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; 10 percent yellowish brown (10YR 5/4) mottles and few fine distinct white (10YR 8/1) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; common moderately thick clay films on ped faces and lining pores; calcareous; moderately alkaline; clear wavy boundary.

B3b—49 to 60 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (10YR 3/2) moist and rubbed; 10 percent fine distinct yellowish brown (10YR 5/4) and 5 percent white (10YR 8/1) mottles; moderate medium subangular blocky structure; hard, friable, sticky and plastic; few thin clay films on ped faces and lining pores; calcareous; moderately alkaline.

The mollic epipedon is more than 16 inches thick. The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 when dry, and chroma of 1 or 2. The C horizon averages 20 to 35 percent clay. It has hue of 10YR or 2.5Y, value of 5 or 6 when dry, and chroma of 2 to 4. The buried profile, where present, has chroma of 0 or 1. A seasonal high water table is at a depth of 42 to 60 inches.

Sinkson series

The Sinkson series consists of deep, well drained soils on toe slopes, fans, and valley sides. These soils formed in colluvium and alluvium derived dominantly from micaceous sandstone. Slope is 1 to 15 percent. Average annual precipitation is about 16 inches, and average annual air temperature is about 40 degrees F.

These soils are fine-loamy, mixed (calcareous), frigid Ustic Torrriorthents.

Typical pedon of Sinkson gravelly sandy loam, 1 to 8 percent slopes, about 400 feet east and 1,425 feet south of the north quarter corner of sec. 24, T. 1 S., R. 92 W.

A1—0 to 3 inches; reddish brown (2.5YR 5/4) gravelly sandy loam, dark reddish brown (2.5YR 3/4) moist; moderate very fine and fine granular structure; soft, very friable, slightly sticky and nonplastic; 20 percent gravel; calcareous; mildly alkaline; clear smooth boundary.

C1—3 to 38 inches; reddish brown (2.5YR 5/4) gravelly loam, dark reddish brown (2.5YR 3/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 25 percent gravel; calcareous; moderately alkaline; gradual wavy boundary.

C2—38 to 60 inches; reddish brown (2.5YR 5/4) gravelly light loam, reddish brown (2.5YR 4/4) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; 35 percent gravel; calcareous; moderately alkaline.

Calcium carbonate is mainly disseminated, but some thin coatings are on the underside of rock fragments. The 10- to 40-inch control section is 15 to 35 percent sandstone fragments that are mainly less than 3 inches in size, but some are the size of cobbles and small stones.

The A horizon has hue of 5YR or 2.5YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 3 to 6 when dry or moist.

The C horizon has hue of 5YR or 2.5YR, value of 4 or 5 when dry and 3 to 5 when moist, and chroma of 3 to 6 when dry or moist.

Starman series

The Starman series consists of shallow, well drained soils on rolling ridges. These soils formed in residuum derived from hard shale. Slope is 5 to 20 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are loamy-skeletal, mixed (calcareous) Lithic Cryorthents.

Typical pedon of a Starman channery loam in an area of Starman-Vandamore complex, 5 to 40 percent slopes, about 150 feet east of Cathedral Bluffs Road, in the SE1/4NW1/4 of sec. 12, T. 3 S., R. 100 W.

A1—0 to 2 inches; grayish brown (10YR 5/2) channery loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, friable, slightly sticky and slightly plastic; 30 percent channery fragments; calcareous; moderately alkaline; clear wavy boundary.

AC—2 to 8 inches; pale brown (10YR 6/3) extremely channery loam, brown (10YR 4/3) moist; weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; 70 percent channery fragments; calcareous; moderately alkaline; clear wavy boundary.

Cca—8 to 17 inches; very pale brown (10YR 8/3) extremely channery loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 75 percent channery fragments and flagstones; rock fragments have thin crusts of secondary lime; calcareous; strongly alkaline; abrupt wavy boundary.

R—17 inches; hard shale.

Depth to lithic contact is 10 to 20 inches. The profile is moderately alkaline or strongly alkaline throughout. The AC and Cca horizons are 65 to 80 percent rock fragments, dominantly 3/4 inch to 3 inches in size. The percentage of coarse fragments more than 3 inches in size increases near the lithic contact.

The A horizon has hue of 7.5YR to 2.5Y, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 2 or 3 when dry or moist. It is 20 to 35 percent rock fragments, mostly fine channery fragments. The AC horizon has hue of 7.5YR to 2.5Y, and it has value of 4 or 5 when moist and 6 or 7 when dry. The Cca horizon has hue of 7.5YR to 2.5Y, and it has value of 4 or 5 when moist and 6 or 7 when dry.

Tampico series

The Tampico series consists of deep, well drained soils on mountainsides. These soils formed in colluvium and alluvium derived from red-bed sandstone and shale. Slope is 8 to 50 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are fine-loamy, mixed Typic Cryoborolls.

Typical pedon of a Tampico loam in an area of Tampico-Miracle complex, 8 to 50 percent slopes, in the SW1/4SE1/4 of sec. 2, T. 2 S., R. 92 W.

O1—3 inches to 0; decomposing leaf and twig litter.

A11—0 to 11 inches; dark reddish gray (5YR 4/2) loam, dark reddish brown (5YR 2/2) moist; strong very fine and fine granular structure; soft, very friable, slightly sticky and slightly plastic; slightly acid; gradual smooth boundary.

A12—11 to 15 inches; reddish gray (5YR 5/2) loam, dark reddish brown (5YR 3/2) moist; moderate fine and medium granular and subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; medium acid; clear wavy boundary.
B1—15 to 30 inches; reddish brown (5YR 4/3) heavy loam, dark reddish brown (5YR 3/4) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 5 percent gravel; slightly acid; clear wavy boundary.
B2—30 to 42 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; 10 percent gravel and cobbles; slightly acid; clear irregular boundary.
C1—42 to 60 inches; reddish brown (2.5YR 5/4) cobbly clay loam, reddish brown (2.5YR 4/4) moist; organic mottles that are dark red (2.5YR 3/6) when moist; massive; hard, firm, sticky and plastic; 20 percent gravel and cobbles; neutral.

The surface litter is 1 inch to 5 inches thick. The profile is 5 to 15 percent rock fragments ranging from gravel to small stones in size above the C horizon and 15 to 30 percent below.

Thornburgh series

The Thornburgh series consists of deep, well drained soils on mountainsides. These soils formed in alluvium and colluvium derived from sandstone. Slope is 15 to 65 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 43 degrees F.

These soils are loamy-skeletal, mixed Typic Cryoborolls.

Typical pedon of a Thornburgh channery loam in an area of Jerry-Thornburgh-Rhone complex, 8 to 65 percent slopes, about 950 feet south and 600 feet east of the northwest corner of sec. 30, T. 2 N., R. 92 W.

A11—0 to 5 inches; very dark grayish brown (10YR 3/2) channery light loam, very dark brown (10YR 2/3) moist; moderate very fine and fine subangular blocky and granular structure; soft, very friable, slightly sticky and nonplastic; 20 percent channery fragments; mildly alkaline; clear smooth boundary.
A12—5 to 14 inches; dark grayish brown (10YR 4/2) channery loam, very dark brown (10YR 2/2) moist; weak medium and coarse subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; 20 percent channery fragments and few angular cobbles; mildly alkaline; clear wavy boundary.
B2—14 to 27 inches; brown (7.5YR 5/4) very channery loam, dark brown (7.5YR 3/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; 35 percent channery fragments and 15 percent angular cobbles; mildly alkaline; clear wavy boundary.
C1—27 to 60 inches; pale brown (10YR 6/5) very channery sandy loam, brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; 40 percent channery fragments and 15 percent angular cobbles; mildly alkaline.

The 10- to 40-inch control section is 35 to 65 percent rock fragments. The profile has hue of 2.5Y to 7.5YR. In some pedons weak accumulations of lime are in the lower part of the C1 horizon.

Tisworth series

The Tisworth series consists of deep, well drained soils on valley floors and broad fans. These soils formed in alluvium weathered mainly from sedimentary rock with a high content of gypsum and alkaline salt. Slope is 0 to 5 percent. Average annual precipitation is about 14 inches, and average annual air temperature is about 43 degrees F.

These soils are fine-loamy, mixed Borollic Natrargids.

Typical pedon of Tisworth fine sandy loam, 0 to 5 percent slopes, 650 feet east and 150 feet north of the southwest corner of the NW1/4 of sec. 5, T. 1 N., R. 96 W.

A2—0 to 4 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak medium and coarse platy structure; slightly hard, very friable, nonsticky and nonplastic; calcareous; strongly alkaline; abrupt wavy boundary.
B2t—4 to 11 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common thin clay films on ped faces; calcareous; very strongly alkaline; clear wavy boundary.
C1ca—11 to 20 inches; very pale brown (10YR 7/3) fine sandy loam, light yellowish brown (10YR 6/4) moist; weak coarse subangular blocky structure; hard, friable, nonsticky and slightly plastic; common to many fine concretions and crystals of gypsum and calcium carbonate; calcareous; very strongly alkaline; clear wavy boundary.
C2—20 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, light yellowish brown (10YR 6/4) moist; massive; hard, very friable, nonsticky and nonplastic; calcareous; very strongly alkaline.

The A1 horizon, where present, has hue of 10YR to 5YR, value of 5 to 7 when dry and 4 or 5 when moist, and chroma of 2 to 4 when dry and 3 or 4 when moist.

The B2t horizon has hue of 10YR to 5YR, value of 4 to 6 when dry and 4 or 5 when moist, and chroma of 3 to 6 when dry or moist. It is strongly alkaline or very strongly alkaline clay loam, sandy clay loam, or loam.

The C horizon has hue of 10YR to 5YR. It is sandy loam to loam and is 5 to 15 percent rock fragments, mainly gravel. It commonly has fine crystalline deposits of gypsum.

Trembles series

The Trembles series consists of deep, moderately well drained soils on alluvial valley floors, flood plains, and low stream terraces. These soils formed in mixed alluvium. Slope is 0 to 3 percent. Average annual precipitation is about 15 inches, and average annual air temperature is about 43 degrees F.

These soils are coarse-loamy, mixed (calcareous), frigid Typic Ustifluvents.

Typical pedon of Trembles loam, wet, 200 feet east and 500 feet south of the northwest corner of sec. 2, T. 1 N., R. 97 W.

A11—0 to 3 inches; light gray (2.5Y 7/2) loam, light yellowish brown (2.5Y 6/4) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

A12—3 to 8 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

C1—8 to 20 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; clear smooth boundary.

C2—20 to 42 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable, nonsticky and nonplastic; few small soft masses of calcium carbonate in upper part; faint yellow (10YR 7/6) and very pale brown (10YR 7/4, moist) mottles in lower part; calcareous; moderately alkaline; clear wavy boundary.

C3—42 to 60 inches; light gray (2.5Y 7/2) stratified sandy loam and fine sandy loam, light brownish gray (2.5Y 6/2) moist; common medium distinct mottles that are pale yellow (2.5Y 7/4) and yellow (2.5Y 7/6) when moist; massive; soft, very friable, nonsticky and nonplastic; calcareous; moderately alkaline.

Worm and insect castings are in the A12 and C1 horizons in most pedons. A seasonal high water table is at a depth of 36 to 60 inches.

Turley series

The Turley series consists of deep, well drained soils on alluvial fans, alluvial valley floors, and low terraces. These soils formed in calcareous alluvium. Slope is 0 to 8 percent. Average annual precipitation is about 10 inches, and average annual air temperature is about 48 degrees F.

These soils are fine-loamy, mixed (calcareous), mesic Typic Torriorthents.

Typical pedon of Turley fine sandy loam, 0 to 3 percent slopes, 350 feet east and 240 feet north of the south quarter corner of sec. 21, T. 2 N., R. 102 W.

A1—0 to 4 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; weak medium platy structure parting to fine granular; soft, very friable, nonsticky; calcareous; moderately alkaline; clear smooth boundary.

AC—4 to 14 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; calcareous; moderately alkaline; clear smooth boundary.

C1—14 to 25 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; calcareous; moderately alkaline; gradual smooth boundary.

C2—25 to 60 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, friable; few fine filaments of white (10YR 8/2) lime and salt crystals; calcareous; strongly alkaline.

The profile has hue of 2.5Y to 10YR.

Uffens series

The Uffens series consists of deep, well drained soils on fans and low terraces. These soils formed in calcareous and saline mixed alluvium. Slope is 0 to 5 percent. Average annual precipitation is about 8 inches, and average annual air temperature is about 48 degrees F.

These soils are fine-loamy, mixed, mesic Typic Natrargids.

Typical pedon of Uffens loam, 0 to 5 percent slopes, 1,200 feet west and 525 feet north of the southeast corner of sec. 12, T. 2 N., R. 104 W.

A2—0 to 2 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium and coarse platy structure parting to moderate fine and medium granular; slightly hard, very friable, nonsticky and nonplastic; calcareous; strongly alkaline; abrupt wavy boundary.

B21t—2 to 8 inches; light yellowish brown (10YR 6/4) light clay loam, yellowish brown (10YR 5/4) moist;

weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; calcareous; strongly alkaline; clear wavy boundary.

B3—8 to 19 inches; very pale brown (10YR 7/4) light clay loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; strongly alkaline; clear wavy boundary.

C1—19 to 24 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate fine to coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

C2—24 to 28 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine filaments or seams of calcium carbonate in root channels and cracks of peds; calcareous; moderately alkaline; abrupt smooth boundary.

C3—28 to 32 inches; very pale brown (10YR 7/3) light loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, nonsticky and nonplastic; calcareous; moderately alkaline; abrupt smooth boundary.

C4—32 to 60 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; calcareous; strongly alkaline.

The B horizon is silty clay loam or clay loam and is 27 to 35 percent clay.

Vandamore series

The Vandamore series consists of moderately deep, well drained soils on rolling ridges. These soils formed in residuum derived from sandstone. Slope is 5 to 40 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are loamy-skeletal, mixed (calcareous) Typic Cryorthents.

Typical pedon of a Vandamore channery loam in an area of Starman-Vandamore complex, 5 to 40 percent slopes, about 50 feet east of Cathedral Bluffs Road, in the SE1/4NW1/4 of sec. 12, T. 3 S., R. 100 W.

A1—0 to 4 inches; light brownish gray (10YR 6/2) channery loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, friable, slightly sticky and slightly plastic; 25 to 30 percent small channery fragments; calcareous; moderately alkaline; clear wavy boundary.

AC—4 to 8 inches; light brownish gray (10YR 6/2) very channery loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, friable, slightly sticky and slightly plastic; 40 percent channery fragments 1 inch to 4 inches in size; calcareous; moderately alkaline; clear wavy boundary.

C1ca—8 to 12 inches; very pale brown (10YR 7/3) extremely channery loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; lime in thin seams and on rock fragments; 70 percent channery fragments 1 inch to 4 inches in size; calcareous; moderately alkaline; clear wavy boundary.

C2ca—12 to 25 inches; very pale brown (10YR 7/3) extremely channery loam, pale brown (10YR 6/3) moist; massive; soft, friable; lime in thin seams and on rock fragments; 80 percent channery fragments 1 inch to 6 inches in size; abrupt wavy boundary.

R—25 inches; hard, fractured, fine-grained sandstone.

Depth to lithic contact ranges from 20 to 40 inches. The fine earth fraction of the control section typically is loam. It commonly is about 20 percent clay, but it ranges from 18 to 25 percent clay. It is 35 to 85 percent rock fragments, dominantly channery fragments. The profile commonly is calcareous throughout, but in some pedons carbonates are leached from the upper few inches. The A and AC horizons have hue of 7.5YR to 2.5Y, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 2 or 3. The Cca horizon has hue of 2.5YR to 2.5Y, value of 6 to 8 when dry and 5 to 7 when moist, and chroma of 3 or 4.

Vandamore Variant

The Vandamore Variant consists of moderately deep, well drained soils on narrow ridgetops and side slopes. The soils formed in residuum derived from sandstone and shale. Slope is 5 to 15 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 38 degrees F.

These soils are loamy-skeletal, mixed (calcareous) Typic Cryorthents.

Typical pedon of a Vandamore Variant channery loam in an area of Waybe-Vandamore Variant-Rock outcrop complex, 5 to 30 percent slopes, 2,200 feet south and 125 feet east of the northwest corner of sec. 20, T. 3 N., R. 93 W.

A1—0 to 5 inches; pale brown (10YR 6/3) channery loam, brown (10YR 4/3) moist; weak medium subangular blocky structure parting to fine subangular blocky; soft, friable, slightly sticky and slightly plastic; 20 percent channery fragments; calcareous; mildly alkaline; clear smooth boundary.

AC—5 to 12 inches; very pale brown (10YR 7/4) very channery loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 40 percent fine channery fragments; calcareous; moderately alkaline; clear wavy boundary.

C1ca—12 to 33 inches; very pale brown (10YR 7/4) very channery loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 45 percent fine channery fragments; few soft masses and seams of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C2r—33 to 60 inches; platy shale and interbedded sandstone.

Depth to paralithic contact ranges from 20 to 40 inches. The profile commonly is calcareous throughout, but in some pedons carbonates are leached from the upper few inches of the profile. The fine earth fraction of the profile commonly is loam, but in some pedons it is clay loam. The A and AC horizons have hue of 2.5Y to 7.5YR, value of 5 to 7 when dry and 4 to 6 when moist, and chroma of 2 to 4. The Cca horizon has hue of 5Y to 7.5YR, value of 5 to 8 when dry and 5 to 7 when moist, and chroma of 2 to 6.

Veatch series

The Veatch series consists of moderately deep, well drained soils on mountainsides. These soils formed in colluvium derived from sedimentary rock. Slope is 12 to 50 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 42 degrees F.

These soils are loamy-skeletal, mixed Typic Haploborolls.

Typical pedon of Veatch channery loam, 12 to 50 percent slopes, 50 feet east and 2,540 feet south of the northwest corner of sec. 15, T. 2 S., R. 96 W.

A1—0 to 8 inches; dark brown (10YR 4/3) channery loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; moderately alkaline; clear wavy boundary.

B21—8 to 13 inches; dark brown (10YR 4/3) channery loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

B22—13 to 18 inches; brown (10YR 5/3) channery light loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

C1ca—18 to 32 inches; very pale brown (10YR 7/3) extremely channery light loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; calcareous; strongly alkaline; clear wavy boundary.

R—32 inches; light gray (10YR 7/2) sandstone.

The mollic epipedon is less than 16 inches thick. Bedrock is at a depth of 20 to 40 inches. The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 2 or 3 when dry or moist. The B horizon has hue of 2.5Y to 7.5YR, value of 5 or 6 when dry and 3 or 4 when moist, and chroma of 2 or 3 when dry or moist. It ranges from channery loam to channery sandy loam and is 15 to 35 percent channery fragments. The C1ca horizon is 30 to 55 percent channery fragments and 10 to 15 percent flagstones.

Walknolls series

The Walknolls series consists of shallow, well drained soils on hills and ridges. These soils formed in residuum derived from sandstone. Slope is 5 to 50 percent. Average annual precipitation is about 8 inches, and average annual air temperature is about 48 degrees F.

These soils are loamy-skeletal, mixed (calcareous), mesic Lithic Torriorthents.

Typical pedon of Walknolls channery sandy loam, 5 to 50 percent slopes, 2,450 feet south and 100 feet west of the northeast corner of sec. 22, T. 2 N., R. 104 W.

A1—0 to 4 inches; pale brown (10YR 6/3) channery sandy loam, dark brown (10YR 4/3) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; 15 percent sandstone fragments; calcareous; moderately alkaline; clear smooth boundary.

C1ca—4 to 12 inches; pale brown (10YR 6/3) extremely channery sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; 70 percent sandstone channery fragments, and 10 percent flagstones 3 to 10 inches across and 1/2 inch to 2 inches thick; calcium carbonate coatings on underside of rock fragments; calcareous; moderately alkaline; gradual smooth boundary.

R—12 inches; laminated hard sandstone.

Rock fragments ranging from channery fragments to flagstones are on the surface. Bedrock is at a depth of 10 to 20 inches. The profile is moderately alkaline or strongly alkaline. The A horizon is 15 to 30 percent sandstone channery fragments. The C horizon typically is 40 to 70 percent sandstone channery fragments and 10 to 15 percent flagstones. Most rock fragments have coatings of calcium carbonate on the underside. The C

horizon is extremely channery sandy loam or very channery loam and is 18 to 27 percent clay.

Waybe series

The Waybe series consists of shallow, well drained soils on narrow ridgetops and steep side slopes. These soils formed in residuum derived from clayey calcareous shale interbedded with thin strata of sandstone. Slope is 5 to 30 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are clayey, mixed (calcareous), shallow Typic Cryorthents.

Typical pedon of Waybe flaggy clay loam in an area of Waybe-Vandamore Variant-Rock outcrop complex, 5 to 30 percent slopes, 2,150 feet east and 1,475 feet north of the southwest corner of sec. 20, T. 3 N., R. 93 W.

A1—0 to 4 inches; pale brown (10YR 6/3) flaggy clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, sticky and plastic; calcareous; mildly alkaline; clear smooth boundary.

C1—4 to 9 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure parting to moderate very fine subangular blocky; slightly hard, friable, very sticky and very plastic; 15 percent sandstone channery fragments; calcareous; moderately alkaline; clear wavy boundary.

C2—9 to 14 inches; light brownish gray (10YR 6/2) channery silty clay loam, dark gray (10YR 4/1) moist; weak coarse subangular blocky structure; slightly hard, firm, sticky and plastic; 20 percent sandstone channery fragments; calcareous; moderately alkaline; clear wavy boundary.

C3—14 to 19 inches; very pale brown (10YR 7/3) channery silty clay loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; hard, firm, sticky and plastic; 30 to 35 percent sandstone and shale channery fragments; calcareous; moderately alkaline; clear wavy boundary.

C4r—19 to 60 inches; platy shale and thin interbedded sandstone strata.

Depth to rock is 10 to 20 inches. The profile has hue of 2.5Y or 10YR throughout. The A horizon has value of 5 to 7 when dry and 4 or 5 when moist, and it has chroma of 2 to 4. The C horizon has value of 5 to 7 when dry and 4 to 6 when moist, and it has chroma of 1 to 4. A discontinuous, thin Cca horizon is above the weathered shale and sandstone in some pedons. It consists mainly of fractured shale and has thin coatings of calcium carbonate on the underside of rock fragments.

Winnemucca series

The Winnemucca series consists of deep, well drained soils on mountainsides and uplands. These soils formed in alluvial and colluvial material weathered mainly from sedimentary bedrock. Slope is 8 to 25 percent. Average annual precipitation is about 20 inches, and average annual air temperature is about 38 degrees F.

These soils are clayey-skeletal, montmorillonitic Argic Pachic Cryoborolls.

Typical pedon of Winnemucca loam in an area of Winnemucca-Clayburn loams, 8 to 25 percent slopes, 200 feet south of the center of the NW1/4 of sec. 18, T. 1 S., R. 92 W.

A11—0 to 8 inches; dark brown (7.5YR 4/2) loam, very dark brown (7.5YR 2/2) moist; moderate fine granular structure; soft, very friable, slightly sticky and slightly plastic; slightly acid; clear wavy boundary.

A12—8 to 16 inches; dark brown (7.5YR 4/2) loam, very dark brown (7.5YR 2/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, very friable, slightly sticky and slightly plastic; 5 percent angular cobbles; slightly acid; clear wavy boundary.

B1—16 to 24 inches; brown (7.5YR 5/2) cobbly heavy loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure parting to fine subangular blocky; slightly hard, friable, sticky and plastic; 15 percent angular cobbles; slightly acid; clear wavy boundary.

B21t—24 to 32 inches; brown (7.5YR 5/4) very cobbly heavy clay loam, dark brown (7.5YR 4/4) moist; strong fine and medium subangular blocky structure; very hard, firm, sticky and plastic; 35 to 45 percent angular cobbles; slightly acid; clear wavy boundary.

B22t—32 to 42 inches; yellowish red (5YR 5/6) very cobbly light clay, yellowish red (5YR 4/6) moist; strong coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; 40 percent angular cobbles and stones; common moderately thick clay films on ped faces; slightly acid; gradual smooth boundary.

C—42 to 60 inches; yellowish red (5YR 5/6) very cobbly light clay grading to cobbly clay loam in the lower part, yellowish red (5YR 4/6) moist; weak coarse subangular blocky structure; very hard, very firm, very sticky and very plastic; 40 percent angular cobbles and stones; slightly acid.

The mollic epipedon is 16 to 25 inches thick. The Bt horizon ranges from clay loam to clay and is 40 percent angular cobbles and some stones. In some pedons the B horizon has some peds that have some slickensides and pressure faces.

Work series

The Work series consists of deep, well drained soils on uplands, terraces, and fans. These soils formed in alluvial and eolian deposits. Slope is 1 to 25 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 38 degrees F.

These soils are fine, montmorillonitic Typic Argiborolls.

Typical pedon of Work loam, 3 to 8 percent slopes, about 140 feet west of powerline and 37 feet south of fence, in the NE1/4NE1/4SE1/4 of sec. 5, T. 3 S., R. 94 W.

A11—0 to 4 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

A12—4 to 10 inches; brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

B21t—10 to 15 inches; brown (10YR 4/3) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to strong fine and medium angular blocky; very hard, friable, sticky and plastic; mildly alkaline; clear wavy boundary.

B22t—15 to 25 inches; light brown (7.5YR 6/4) heavy clay loam, dark brown (7.5YR 4/2) moist; moderate medium prismatic structure parting to strong fine and medium angular blocky; very hard, firm, sticky and plastic; mildly alkaline; clear wavy boundary.

B3ca—25 to 30 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 4/4) moist; weak coarse subangular blocky structure; hard, friable, sticky and plastic; few fine soft masses of calcium carbonate; mildly alkaline; clear wavy boundary.

C1ca—30 to 50 inches; pink (7.5YR 7/4) light clay loam that has common fine and medium distinct seams, blotches, and specks of white (10YR 8/2) lime, brown (7.5YR 5/4) moist when rubbed; massive; hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; gradual wavy boundary.

C2ca—50 to 60 inches; pink (7.5YR 7/4) light loam, brown (7.5YR 4/4) moist; few fine soft masses of calcium carbonate; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The mollic epipedon is 10 to 16 inches thick and in places includes part of the argillic horizon. The profile has hue of 10YR or 7.5YR. Depth to a horizon of secondary lime accumulation is 18 to 50 inches.

The A and B horizons are neutral or mildly alkaline. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 to 4. The B horizon is 35 to 45 percent clay and is clay loam or clay. The B2t horizon has value of 4 to 6 when dry and 3 to 5 when moist, and it has chroma of 2 to 4. The Cca horizon has value of 5 to 7 when dry and 4 to 6 when moist, and it has chroma of 2 to 4. It is 0 to 25 percent coarse fragments, mainly gravel.

Yamac series

The Yamac series consists of deep, well drained soils on rolling uplands, fans, and terraces. These soils formed in alluvium and some eolian material. Slope is 2 to 15 percent. Average annual precipitation is about 14 inches, and average annual air temperature is about 43 degrees F.

These soils are fine-loamy, mixed Borollic Camborthids.

Typical pedon of Yamac loam, 2 to 15 percent slopes, in the SW1/4SW1/4 of sec. 2 T. 2 S., R. 99 W.

A1—0 to 4 inches; brown (10YR 5/3) loam, dark grayish brown (10YR 4/2) moist; weak fine and medium platy structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; 5 percent fine channery fragments; calcareous; moderately alkaline; clear smooth boundary.

B2—4 to 12 inches; brown (10YR 5/3) heavy loam, brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; 5 percent channery fragments; calcareous; moderately alkaline; clear wavy boundary.

B3ca—12 to 22 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; 5 percent channery fragments; common fine and medium soft masses of lime; moderately alkaline; clear wavy boundary.

C1ca—22 to 48 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 10 percent channery fragments; well disseminated lime; calcareous; strongly alkaline; gradual wavy boundary.

C2—48 to 60 inches; pale brown (10YR 6/3) light loam, brown (10YR 5/3) moist; massive; soft, friable, slightly sticky and slightly plastic; 10 percent channery fragments; calcareous; moderately alkaline.

The upper horizons of some pedons are noncalcareous. Most pedons are 0 to 15 percent fine channery fragments throughout.

Zoltay series

The Zoltay series consists of deep, well drained soils on alluvial fans, terraces, and valley sides. These soils formed in alluvium derived mainly from sedimentary rock. Slope is 1 to 25 percent. Average annual precipitation is about 18 inches, and average annual air temperature is about 40 degrees F.

These soils are fine, montmorillonitic Pachic Argiborolls.

Typical pedon of Zoltay clay loam, 8 to 15 percent slopes, 2,025 feet west and 650 feet north of the southeast corner of sec. 6, T. 1 S., R. 93 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) light clay loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to moderate fine granular; soft, very friable, slightly sticky and slightly plastic; 10 percent rock fragments; mildly alkaline; clear smooth boundary.

B1—8 to 13 inches; very dark grayish brown (10YR 3/2, dry and moist) clay loam; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, sticky and plastic; 10 percent sandstone fragments; few thin patchy clay films on ped faces; mildly alkaline; clear smooth boundary.

B2t—13 to 22 inches; brown (10YR 4/3) cobbly heavy clay loam, dark brown (10YR 3/3) moist; strong medium subangular blocky structure parting to moderate fine angular blocky; hard, firm, sticky and plastic; 20 percent cobble-sized sandstone fragments; common thin clay films on ped faces; moderately alkaline; clear wavy boundary.

B3ca—22 to 31 inches; pale brown (10YR 6/3) cobbly clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; 30 percent sandstone fragments; seams and soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C1ca—31 to 40 inches; very pale brown (10YR 7/3) cobbly clay loam, pale brown (10YR 6/3) moist; massive; hard, friable, sticky and plastic; 30 percent sandstone fragments; common medium and large seams of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C2ca—40 to 60 inches; very pale brown (10YR 7/3) cobbly loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 25 percent sandstone fragments and 10 percent stones; disseminated calcium carbonate and few faint soft masses of calcium carbonate; calcareous; moderately alkaline.

The A and B1 horizons are 5 to 15 percent rock fragments, mainly gravel and a few cobbles. Many rock fragments have thin coatings of calcium carbonate on the underside. The B horizon is cobbly clay loam to cobbly clay and is 35 to 45 percent clay. The continuous zone of calcareous material is at a depth of 10 to 40 inches. Secondary calcium carbonate commonly is below a depth of 20 inches.

formation of the soils

The formation of the soils involves a process consisting of two steps: (1) the accumulation of parent material and (2) the differentiation of horizons in the profile (*3, 5*).

Horizon differentiation in soils results from four basic kinds of change: addition of material, leaching or removal of material, shifting of position of material in the soil, and chemical changes. These four changes interact in the formation of most soils, but they are much more evident in some soils than in others. In some, for example, more rainfall has resulted in more removal of bases and addition of organic matter. In others more clay has moved from the surface layer to the subsoil over a period of time.

Many properties of soils are products of addition, removal, translocation, or transformation of organic matter, bases, soluble salts, carbonates, sesquioxides, or silicate clay minerals. Organic matter is added to the surface and transformed into humus by decay. Where drainage is good, salts and gypsum are moved downward and, except in the drier areas, are removed from the soils. Lime is also removed from some soils, and in others it accumulates at the depth of normal moisture penetration. In some coarse-textured or very channery or gravelly soils, some clay also has moved all the way through the soil. In some other soils, clay has moved only part of the way downward. Soils in which lime and clay have moved partially downward have clay at a shallower depth than the lime. For example, most of the clay accumulation in the Zoltay soils is at a depth of about 13 to 22 inches and most of the lime accumulation is at a depth of about 31 to 40 inches.

In soils where drainage is restricted, salts, gypsum, and lime are dissolved and move upward with the capillary water. When the water reaches the surface and evaporates, these substances precipitate at or near the surface. The salt crust on the surface of the Hagga soils is a result of this process.

When iron-bearing minerals, such as pyroxene and biotite, weather in areas where drainage is good, the iron is ferric and the soil material is brownish or reddish. This process is most active where there is a good source of iron, where the soil material is warm and moist, and where there is surface litter that contributes organic acids that help to release iron. Time is needed for the released iron to move downward and concentrate in a lower soil horizon. Most of the reddish soils in this survey area, such as the Kamack and Miracle soils, are red because of the color of the parent material and not

because of the content of iron. The Absarokee soils, however, do have a concentration of iron, as indicated by a reddish color in the upper part of the subsoil.

The gray color of the lower horizons of the poorly drained Hagga soils indicates that the iron has changed to the ferrous, or reduced, form. Such a reduction of iron in soils commonly is accompanied by some transfer of iron. Iron may be removed completely from some horizons or from the entire soil profile. In this survey area, however, the iron generally has moved only a short distance and has remained either in the horizon of origin or in an adjacent horizon. Although somewhat poorly drained, the Redrob soils exhibit only a slight reduction of iron. This is partly because of the presence of a fluctuating water table, which allows for seasonal oxidation. Also, because of the rate of flow of the White River, which is the chief source of the water table, there is enough oxygen in the water to retard the reduction process.

There are five principal factors of soil formation: parent material; climate; relief; living organisms, or biological activity; and time. The soil-forming factors are interdependent, each modifying the effectiveness of the others (*11*).

Soil is the result of the combined effects of these five factors, and soil differences principally are a result of the relative importance, or strength, of the various factors. In mountainous areas such as the eastern third of the survey area, changes in one or more soil-forming factors occur within relatively short distances. Many kinds of soil form because of the many microclimates, which are the result of differences in elevation, air drainage, and topography, including slope gradient and aspect. Changes in other factors such as parent material, relief, and time further increase the number of different kinds of soil in the area.

The five factors of soil formation are described in the following pages.

parent material

The geology and geomorphology of the area help to explain the distribution of parent material and the slope of the soils.

In the eastern part of the area are masses of basalt and ridges of tilted Permian red beds. One of these tilted ridges, the Iles Member of the Mesa Verde Group, runs parallel to Colorado Highway 13-789. The parent material in the western two-thirds of the survey area generally is horizontally bedded or only slightly tilted. It consists of sandstone, shale, and marlstone and generally is calcareous. Areas where the shale is not capped or interbedded with hard sandstone are deeply worn and consist mainly of low knolls. The soils in these areas, therefore, are more gently sloping. Areas where much of the surface is capped by hard material are characterized by entrenched drainageways. There are about two of these drainageways per mile, and they are as much as 200 feet deep. Most of the interfluves are sloping to moderately steep.

In the western two-thirds of the area are some deposits of windblown material. Some quartzitic material has also been deposited in the survey area as part of glacial outwash.

Parent material influences the physical and chemical characteristics of soils. Some of the physical properties that parent material influences are the depth of the soil, amount and size of rock fragments, and amount of sand, silt, and clay. These properties, in turn, influence permeability and consistence. The resistance of the soil to piping and slumping is also influenced by the physical properties of the parent material.

The chemical properties that parent material directly affect include the mineralogy of the clay and the amount of lime, gypsum, and soluble salts in the soil. Soil color reflects the chemical composition of the soil, particularly in the subsurface layer.

In places where the climate is dry and the vegetation is sparse, such as in much of the northwestern part of the survey area, the influence of parent material is readily apparent. In moist and densely vegetated areas at higher elevations, the role of parent material is modified chiefly by removal of salts, deep leaching of lime, and more masking of the mineral color because of the content of organic matter.

The sources of parent material in the area are discussed in the following paragraphs.

Basalt is stable and weathers only by chemical processes. Partly because of its slow permeability, basalt weathers at a relatively slow rate; therefore, stones characteristically remain in the soil and on the surface.

Basalt is moderately high in content of minerals that contain calcium and sodium. It tends to weather to soils that are at least moderate in content of clay, mainly montmorillonitic. These soils generally have a high percentage of base saturation, and their reaction normally is near neutral. Because of the content of iron in basalt, the soils are brownish or reddish in color. Delson soils are an example of soils that formed in basalt. These soils have a high content of stones, have a brownish colored loamy surface layer, and are neutral.

Permian red beds are some of the oldest rock in the survey area. They are mainly reddish micaceous sandstone and clayey shale that commonly are steeply tilted. Soil material derived from Permian red beds includes residuum and alluvium that has retained most of the distinguishing characteristics of residuum. The soils that formed in this material are dominantly fine sandy loam and loam and have varying amounts of rock fragments. The Miracle, Tampico, and Sinkson soils formed in material derived from Permian red beds.

Mancos Shale is in much of the northwestern and northeastern parts of the survey area. Soils in the drier western corner of the area that formed in Mancos Shale

are grayish colored, are high in content of soluble salts, and have many crystals of gypsum. Chipeta soils are an example. Soils that formed in material weathered from Mancos Shale and that receive more than 16 inches of precipitation are subject to slumping. Burnette soils are an example. Most of the Dollard soils formed in material derived from Mancos Shale, and the Billings soils formed in alluvium derived from Mancos Shale.

The *Wasatch Formation* is mainly rugged areas of multicolored shale interbedded with sandstone. It readily weathers to clay that has a high potential for shrinking and swelling upon drying and wetting or that tends to slump when wet. In places the clay is bentonite. The clay is calcareous and contains some gypsum and salts. The steepness of slope below the protective strata of sandstone influences soil properties, and the susceptibility to mudflow retards development of a subsoil. Some of the Moyerson and Dollard soils formed in material derived from the Wasatch Formation, and the Absher and Tisworth soils formed in alluvium derived from this formation.

The *Mesa Verde Group* is along the margins of the Piceance Creek Basin and is characterized by rugged escarpments. This group is composed of massive sandstone interbedded with sandy shale and many beds of coal and carbonaceous shale. The sandstone commonly is medium-textured or coarse-textured.

The shale and the cementing agent in the sandstone contain some salts. The soils that developed in this material typically occur in complex, reflecting the interbedding of the rock. The massive sandstone typically weathers to soils such as the shallow Rentsac soils. Soils that weather from the shale are clayey and commonly contain salts and gypsum. Moyerson soils are an example.

By dispersing clay, sodium accelerates the downward movement of clay from the surface layer. Therefore, soils that form in parent material such as that of the Wasatch Formation and the Mesa Verde Group, which have more salts than gypsum, generally have a natric horizon. This partially accounts for the formation of Uffens and Tisworth soils in a climatic regime that normally does not promote development of a distinct clayey subsoil. Other parent material that is high in content of lime and low in salt has the opposite effect. The calcium ion flocculates clay, retarding its transfer from the surface layer. Kinnear, Guben, Midway, Yamac, and Redcreek soils are examples of calcareous soils that have little or no subsoil development.

The *Uinta Formation* includes most of the capping of the Piceance Creek Basin. This formation consists mostly of brownish to gray silty sandstone, siltstone, and some marlstone and shale. It is fairly resistant to weathering. Soils that formed in this parent material are characterized by limited depth to hard rock, a high content of channery fragments, loamy texture, and a high percentage of base saturation. Because the channery fragments are better conductors of heat than is the soil material, they influence soil temperature, especially in open areas and in south-facing areas. Walknolls, Rentsac, Irigul, and Parachute soils formed in this material.

The *Parachute Member* of the *Green River Formation* underlies much of the survey area. Because it is exposed at the surface only on the Cathedral Bluffs and in some incised drainageways within the Piceance Creek Basin, its influence on the soils in the area is confined to those areas. It is chiefly marlstone that is highly calcareous, very hard, and resistant to weathering. Soils that formed in this parent material are relatively high in content of material that is not weathered to silt and clay and in content of small calcareous rock fragments. Slow release of lime from the small rock fragments replaces the lime that is leached; therefore, the soils are calcareous throughout. Razorba soils formed in this material.

The *Garden Gulch Member* of the *Green River Formation* consists of dark grayish colored shale that readily breaks down to clay. The soils that formed in this material generally are at least moderately deep and are clayey. Kobar and Abor soils formed in this material.

Loess and other wind-deposited material cap some of the more nearly level mesas and broad ridgetops in the survey area. It is mostly on north- and northeast-facing slopes. Soils that formed in loess have a low content of rock fragments, are silty or fine-loamy, and are calcareous. Forelle and Yamac soils are examples.

Eolian material is in the extreme northwestern part of the survey area. It is wind-deposited material that is somewhat sandy. Clay moves easily through this material, and the subsoil generally is highly developed. Potts and Begay soils formed in this material.

Glacial outwash commonly is on the sides of terraces. It contains a large amount of coarse material, including quartzitic cobbles and stones mixed with sand. Guben and Cliffdown soils formed in this material.

climate

Climate in the survey area influences the kind of vegetation that grows on soils, the level of biological activity in soils, and the physical and chemical weathering of parent material. Soil temperature and moisture are the main factors. Such factors as wind velocity and humidity also have a significant influence on soil formation.

The survey area has a semidesert to cool mediterranean climate. The average annual precipitation is 8 to 20 inches. The average annual air temperature ranges from 38 to 48 degrees F; however, temperature varies widely between seasons. Summers usually are warm, and winters are cold. The length of the growing season averages 85 to 130 days. The amount of precipitation and variations in temperature contribute to

the accumulation of organic matter in the soils, to the movement of substances in suspension or solution, and to the rate of chemical processes.

The southern and eastern three-fourths of the area receive 15 to 20 inches of precipitation, and the northwestern quarter of the area receives 8 to 14 inches. The amount of precipitation is relatively evenly distributed throughout the year. Because of the limited amount of precipitation in the area, calcium carbonate is leached only to a shallow depth. Depth to calcium carbonate generally is less in the western part of the area.

Because of relatively low rainfall, infrequent high temperatures, cool nights, and the shallow depth to which frost penetrates, chemical and biological processes occur slowly in the survey area. The amount of organic matter is lower in areas of lower precipitation. As a result, the soils have a thin surface layer and are light colored in these areas.

Where the soils are dry-farmed or are used for livestock grazing, they seldom are wet below the depth to which roots penetrate except during very wet years. The low humidity results in a high loss of water through evaporation. This loss reduces the amount of water that percolates through the soil; therefore, the depth to which roots penetrate and the depth to which calcium carbonate is leached are relatively shallow.

Strong winds in some areas have removed much of the original surface layer of the silty and sandy soils in the area and have exposed the subsoil and substratum.

living organisms

The kind and amount of vegetation, micro-organisms, earthworms, and other organisms that live on and in the soil contribute to soil formation.

The vegetation in most of the area consists chiefly of various kinds and amounts of grasses and shrubs. Living roots help to widen fractures in rock, and the network of tubes and pores left by decomposing roots hasten the passage of air and water through the soil. This permits deeper penetration of water and contributes to the breakdown of minerals.

Root respiration creates an acid environment and accelerates the breakdown of feldspar and other minerals. Some of the released elements reassemble as silicate clay. Except at the highest elevations, plants growing on the north-facing slopes have more roots than those on the drier, south-facing slopes; thus, there is more root respiration in the soils on north-facing slopes. Because of this process of weathering through root respiration, reduced erosion, and more effective precipitation, soils on the north-facing slopes have a more distinct subsoil than those on the warmer, south-facing slopes. Less mixing of material by rodents and earthworms may occur in some of the colder areas, resulting in stronger subsoil development.

Humus contributes to the stability of soil structure, increasing the resistance of soils to erosion. Humus also affects the color of soils. A surface layer that has value of 2 when moist generally has an organic matter content of 3 percent or more, and a surface layer that has value of 4 when moist generally has an organic matter content of less than 3 percent and commonly of less than 1.5 percent.

Organic matter provides food for bacteria, actinomycetes, and fungi and influences the activity of earthworms and insects, which affects the activity of small burrowing animals. Especially in the soils that support grasses and receive 18 inches or more of precipitation, earthworms contribute considerably to soil mixing and aeration. Soils that support conifer forest typically are not subject to as much mixing of material by earthworms. Therefore, less surface litter is mixed into the soil and organic matter content decreases abruptly with depth. Soils under conifers generally have a light colored or only moderately dark colored surface layer. Cowdrey soils formed under conifers.

Insect burrowing leaves thin deposits of soil material on the surface. Precipitation removes more of the finer clay particles than of the coarser sand from this loose soil material, resulting in a soft, friable surface layer in which seedlings can root easily.

Especially in the warmer soils, ground squirrels and prairie dogs have mixed some of the more friable and calcareous material. This enables water to leach more deeply into the soil, but it also restricts the development of distinct soil horizons. Rodent activity concentrates pebbles and channery fragments on the surface, thus helping to protect the soil from erosion.

relief

Relief is influenced mainly by the geology of the area. Rock structure and the presence or absence of hard layers that are resistant to erosion mainly determine the length, shape, and gradient of slopes. Slope and aspect affect the proportion of water that enters the soil as compared to the amount that runs off, which in turn affects the kind and degree of soil genesis that takes place. The kinds of landform present and their contour affect the hazard of erosion and the velocity and direction of the wind.

In most of the survey area, moisture is in short supply for at least part of each growing season; however, extra amounts of water are stored in some areas during periods of moisture recharge. The water is stored in nearly level areas where runoff is minimized, in concave areas that tend to collect runoff, and in areas that receive runoff from higher lying areas. All of these areas tend to have thicker and more strongly developed horizons, are more strongly leached, and are darker in color.

Because of the variations in relief on the Roan Plateau, the parent material typically develops into different soils. The deep Rhone soils and moderately deep Parachute soils formed in parent material on the northerly aspects. The shallow Irigul soils formed on the southerly aspects. The very minimally developed, shallow and moderately deep Starman and Vandamore soils formed on the windswept crests.

Relief is especially significant in determining the extent of soil development in the less permeable material such as that derived from shale. In the Rangely area, very steep, convex, south-facing slopes may erode to Badland, which exhibits little if any soil formation. In the less steeply sloping and less convex areas, shallow soils such as Chipeta and Moyerson soils form. In areas that retain moisture, such as those on moderately sloping, concave, or north-facing slopes, the moderately deep Gaynor and Killpack soils formed from material derived from shale.

Some soils in swales and low-lying positions adjacent to streams show the effects of a high water table. They have a moderate to high content of organic matter, altered minerals and released iron minerals, and a recharge of bases and salts. An example is the Newfork soils that have a moderately thick, very dark gray surface layer because of the content of organic matter. The subsoil has common prominent yellowish brown and brownish yellow mottles as a result of the release of iron from augite and other iron-bearing minerals. Another example is the Hagga soils that have a concentration of lime, gypsum, and salt in the surface layer in fall after irrigation. These minerals are carried in the ground water and brought to the surface by capillary action.

time

The soils in the survey area are very young to old. Rivra soils in areas of active deposition from flash flooding are among the youngest soils. Work soils on mesas that receive little if any fresh deposits of material are among the oldest.

Soil formation or development relates mainly to the length of time the other four soil-forming factors have interacted. The geologic age of parent material has little to do with the age of soils.

As soils increase in age, significant changes occur that affect plant nutrition and permeability to roots, air, and water. Bases, such as calcium, magnesium, sodium, and potassium, move downward in the soil profile. Feldspar weathers to silicate clay and accumulates in the subsoil. Color also changes as soils develop, which indicates an increase in iron oxide with age. For example, the younger Perma soils that are forming in basaltic material have hue of 10YR throughout; the more highly developed Delson soils have a surface layer of 7.5YR and a subsoil of 5YR.

A typical kind and sequence of soil development or aging is illustrated by the Patent and Work soils. The Patent soils formed in relatively young alluvial, colluvial, and eolian deposits. Not enough time has lapsed for either lime or clay to have moved from the surface layer to the underlying layers. The Work soils are on older mesas. Lime is concentrated at a depth of more than 2 feet. Some feldspar has weathered to clay, and some of the clay has leached downward from the surface. The lime and clay have accumulated in the subsoil at a depth of more than 10 inches, and the transported clay has largely clogged pores, making further downward movement of clay and water more difficult. The subsoil also is redder than the surface layer because of some formation and concentration of iron oxide.

Another kind of sequence in soil development is observed in soils that have a high content of minerals in the parent material that can be weathered and have a high base content. These soils may become deeper with age, but there is little increase in the content of clay in the subsoil. Clay apparently is formed in the soils faster than it is moved downward by percolating rainwater and snowmelt. Cracks form in the soils as they dry, and granular soil material from the surface falls into the cracks and mixes with material in the deeper layers. Gaynor, Dollard, and Abor soils are examples of this kind of soil development.

In much of the survey area, geologic erosion has proceeded too rapidly for the soils to weather to a depth of as much as 20 inches or for distinct horizons to have developed. Therefore, more than one-half of the area consists of miscellaneous areas and soils that are less than 20 inches deep and less than 5 percent of the soils in the area have an argillic horizon.

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glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial valley floors. The floors of alluvial valleys that are covered with unconsolidated stream-laid deposits. The water in the streams in these valleys is sufficient for subirrigation or for flood irrigation of crops.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Anion. A negative ion. The opposite of a cation.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially

drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An

explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average

height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days[1]	Average	Less than--	More than--	Average number of days with 0.1 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
Recorded in the period 1951-74 at Rangely, Colo.											
January----	31.7	1.0	16.4	52	-28	25	0.38	0.16	0.92	2	11.2
February---	39.5	8.2	23.9	59	-23	53	.67	.18	1.05	2	6.9
March------	50.4	19.8	35.1	73	-6	81	.63	.16	.99	2	5.9
April------	62.8	30.6	46.7	82	14	220	.81	.36	1.18	3	1.8
May--------	74.7	39.6	57.2	90	23	533	.75	.21	1.18	3	.1
June-------	84.9	46.8	65.9	100	32	777	.73	.11	1.22	2	.0
July-------	91.8	53.5	72.7	101	41	1,014	.76	.12	1.27	2	.0
August-----	88.6	50.3	69.5	99	34	915	1.06	.31	1.65	3	.0
September--	79.3	39.7	59.5	94	24	585	1.05	.16	1.75	3	.6
October----	66.9	29.2	40.1	84	11	273	.96	.26	1.51	3	1.1
November---	49.0	18.2	33.6	68	-5	47	.63	.21	.97	2	4.6
December---	34.8	5.2	20.0	54	-21	11	.64	.19	.99	2	9.1
Year-----	62.9	28.5	45.7	102	-30	4,334	9.27	6.91	11.48	29	41.3
Recorded in the period 1951-74 at Meeker, Colo.											
January---	37.1	7.9	22.5	54	-25	12	1.12	.62	1.52	5	17.5
February--	40.9	11.9	26.4	58	-18	16	1.08	.43	1.60	4	17.5
March-----	47.4	19.4	33.0	68	-6	39	1.31	.58	1.90	5	13.4
April-----	58.0	27.5	42.8	76	8	128	1.62	.96	2.20	6	6.4
May-------	69.6	35.2	52.4	85	19	384	1.44	.52	2.17	5	.9
June------	79.4	41.6	60.5	92	28	615	1.36	.51	2.03	4	.1
July------	86.1	48.0	67.0	95	36	837	1.41	.58	2.08	4	.0
August----	83.3	45.8	64.6	93	32	763	1.81	.88	2.57	5	.0
September-	75.6	36.7	56.2	90	22	486	1.46	.32	2.33	4	1.1
October---	64.5	28.5	46.5	81	11	216	1.47	.55	2.21	4	2.3
November--	48.7	18.8	33.8	68	-9	37	1.13	.59	1.56	4	9.9
December--	38.1	9.7	23.9	57	-20	0	1.43	.87	1.92	5	17.3
Year-----	60.7	27.6	44.2	95	-27	3,533	16.64	13.72	19.43	55	84.0

See footnote at end of table.

TABLE 1.--TEMPERATURE AND PRECIPITATION--Continued

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days[1]	Average	Less than--	More than--	Average number of days with 0.1 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
Recorded in the period 1951-74 at Little Hills, Colo.											
January---	38.2	4.9	21.8	56	-32	11	0.70	0.35	0.98	2	11.4
February--	42.2	8.4	25.2	60	-24	19	.80	.26	1.23	3	12.3
March-----	48.1	15.9	32.0	68	-14	31	.97	.45	1.38	4	11.3
April-----	58.1	24.2	41.2	76	6	99	1.40	.77	1.91	5	5.2
May-------	69.2	32.1	50.7	84	15	332	1.17	.43	1.75	4	.6
June------	79.3	38.5	58.9	92	24	567	1.08	.27	1.71	3	.1
July------	86.1	45.6	65.9	95	31	803	.99	.40	1.45	3	.0
August----	83.3	44.4	63.9	93	28	741	1.58	.59	2.37	4	.0
September-	75.4	34.1	54.8	89	17	444	1.15	.12	1.93	3	.7
October---	64.7	24.2	44.5	80	5	173	1.10	.27	1.76	3	2.8
November--	49.1	15.3	32.2	67	-15	28	.96	.50	1.33	3	7.6
December--	39.3	6.0	22.6	58	-25	0	1.03	.52	1.44	3	14.0
Year-----	61.1	24.5	42.8	95	-33	3,248	12.93	10.56	15.15	40	66.0

[1]A growing degree day is an index of the amount of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Minimum temperature		
	24°F or lower	28°F or lower	32°F or lower
Recorded in the period 1951-74 at Rangely, Colo.			
Last freezing temperature in spring:			
1 year in 10 later than--	May 06	May 20	June 11
2 years in 10 later than--	April 30	May 13	June 05
5 years in 10 later than--	April 19	May 04	May 22
First freezing temperature in fall:			
1 year in 10 earlier than--	September 20	September 11	August 27
2 years in 10 earlier than--	September 27	September 17	September 03
5 years in 10 earlier than--	October 10	September 29	September 17
Recorded in the period 1951-74 at Meeker, Colo.			
Last freezing temperature in spring:			
1 year in 10 later than--	May 21	June 12	June 23
2 years in 10 later than--	May 15	June 05	June 17
5 years in 10 later than--	May 05	May 23	June 06
First freezing temperature in fall:			
1 year in 10 earlier than--	September 13	September 02	August 21
2 years in 10 earlier than--	September 19	September 09	August 26
5 years in 10 earlier than--	September 30	September 20	September 05

TABLE 2.--FREEZE DATES IN SPRING AND FALL--Continued

Probability	Minimum temperature		
	24°F or lower	28°F or lower	32°F or lower
Recorded in the period 1951-74 at Little Hills, Colo.			
Last freezing temperature in spring:			
1 year in 10 later than--	June 11	June 22	July 02
2 years in 10 later than--	June 04	June 16	June 28
5 years in 10 later than--	May 22	June 04	June 20
First freezing temperature in fall:			
1 year in 10 earlier than--	September 04	August 14	July 14
2 years in 10 earlier than--	September 09	August 22	July 26
5 years in 10 earlier than--	September 19	September 06	August 18

TABLE 3.--GROWING SEASON

Probability	Daily minimum temperature		
	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days
Recorded in the period 1951-74 at Rangely, Colo.			
9 years in 10	150	124	84
8 years in 10	158	132	95
5 years in 10	173	147	117
2 years in 10	188	162	138
1 year in 10	196	169	149
Recorded in the period 1951-74 at Meeker, Colo.			
9 years in 10	123	90	65
8 years in 10	131	100	74
5 years in 10	147	120	90
2 years in 10	163	140	107
1 year in 10	172	150	116
Recorded in the period 1951-74 at Little Hills, Colo.			
9 years in 10	93	60	19
8 years in 10	102	71	33
5 years in 10	120	93	59
2 years in 10	138	114	84
1 year in 10	147	126	98

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Abor clay loam, 5 to 30 percent slopes	11,847	0.7
2	Absarokee-Delson channery loams, 8 to 65 percent slopes	9,478	0.6
3	Absher loam, 0 to 3 percent slopes	1,257	0.1
4	Absher loam, 3 to 8 percent slopes	1,830	0.1
5	Badland	16,391	1.0
6	Barcus channery loamy sand, 2 to 8 percent slopes	7,609	0.4
7	Billings silty clay loam, 0 to 5 percent slopes	7,153	0.4
8	Billings-Torrifluvents complex, gullied, 0 to 5 percent slopes	4,889	0.3
9	Blakabin-Rhone-Waybe complex, 5 to 50 percent slopes	12,364	0.7
10	Blazon, moist-Rentsac complex, 8 to 65 percent slopes	65,928	3.9
11	Borollic Calciorthids-Guben complex, 6 to 50 percent slopes	3,182	0.2
12	Bucklon-Inchau loams, 25 to 50 percent slopes	209	*
13	Bulkley channery silty clay loam, 5 to 30 percent slopes	7,702	0.5
14	Bulkley-Abor clay loams, 5 to 30 percent slopes	4,061	0.2
15	Castner channery loam, 5 to 50 percent slopes	60,588	3.6
16	Chipeta silty clay loam, 3 to 25 percent slopes	12,981	0.8
17	Chipeta silty clay loam, 3 to 25 percent slopes, eroded	4,026	0.2
18	Chipeta-Killpack silty clay loams, 3 to 15 percent slopes	11,274	0.7
19	Chipeta-Walknolls complex, 5 to 15 percent slopes	6,620	0.4
20	Clayburn loam, 3 to 15 percent slopes	1,595	0.1
21	Cliffdown-Cliffdown Variant complex, 5 to 65 percent slopes	3,516	0.2
22	Clifterson channery loam, 1 to 15 percent slopes	761	*
23	Cochetopa loam, 9 to 50 percent slopes	2,520	0.1
24	Cochetopa-Jerry loams, 12 to 25 percent slopes	1,545	0.1
25	Colorow sandy loam	3,693	0.2
26	Cowdrey-Tampico loams, 15 to 50 percent slopes	3,496	0.2
27	Curecanti very cobbly loam, 1 to 8 percent slopes	464	*
28	Delson-Perma complex, 3 to 65 percent slopes	2,298	0.1
29	Dollard silty clay loam, 3 to 8 percent slopes	1,190	0.1
30	Dollard silty clay loam, 8 to 15 percent slopes	4,007	0.2
31	Dollard silty clay loam, 15 to 40 percent slopes	6,963	0.4
32	Fluvaquents, frequently flooded	1,019	0.1
33	Forelle loam, 3 to 8 percent slopes	16,295	1.0
34	Forelle loam, 8 to 15 percent slopes	5,594	0.3
35	Gaynor-Midway silty clay loams, dry, 2 to 25 percent slopes	5,799	0.3
36	Glendive fine sandy loam	31,569	1.9
37	Glenton sandy loam, 1 to 6 percent slopes	1,402	0.1
38	Guben loam, 0 to 3 percent slopes	133	*
39	Guben loam, 3 to 8 percent slopes	669	*
40	Hagga loam	2,992	0.2
41	Havre loam, 0 to 4 percent slopes	16,272	1.0
42	Irigul channery loam, 5 to 50 percent slopes	27,086	1.6
43	Irigul-Parachute complex, 5 to 30 percent slopes	41,646	2.5
44	Jerry loam, 12 to 45 percent slopes	2,377	0.1
45	Jerry-Thornburgh-Rhone complex, 8 to 65 percent slopes	40,333	2.4
46	Kinnear fine sandy loam, 1 to 5 percent slopes	2,553	0.2
47	Kobar silty clay loam, 0 to 3 percent slopes	3,405	0.2
48	Kobar silty clay loam, 3 to 8 percent slopes	12,000	0.7
49	Kobar silty clay loam, 8 to 15 percent slopes	2,414	0.1
50	Lamphier-Tampico-Kamack loams, 5 to 60 percent slopes	12,235	0.7
51	Mergel-Redthayne-Dollard complex, 8 to 65 percent slopes	15,766	0.9
52	Miracle fine sandy loam, 3 to 25 percent slopes	9,595	0.6
53	Moyerson stony clay loam, 15 to 65 percent slopes	44,014	2.6
54	Nagitsy-Irigul channery loams, 5 to 50 percent slopes	10,646	0.6
55	Nihill channery sandy loam, 5 to 50 percent slopes	1,402	0.1
56	Northwater loam, 5 to 50 percent slopes	7,888	0.5
57	Owen Creek-Jerry-Burnette loams, 5 to 35 percent slopes	27,669	1.6
58	Parachute loam, 25 to 75 percent slopes	26,202	1.5
59	Parachute-Rhone loams, 5 to 30 percent slopes	13,453	0.8
60	Patent loam, 0 to 3 percent slopes	1,574	0.1
61	Patent loam, 3 to 8 percent slopes	12,309	0.7
62	Patent loam, 8 to 15 percent slopes	3,006	0.2
63	Patent loam, 15 to 25 percent slopes	914	0.1
64	Piceance fine sandy loam, 5 to 15 percent slopes	17,896	1.1
65	Pinelli clay loam, 3 to 12 percent slopes	1,559	0.1
66	Potts-Begay fine sandy loams, 2 to 7 percent slopes	6,128	0.4
67	Rabbitex flaggy loam, 10 to 65 percent slopes	7,619	0.4
68	Rabbitex-Work loams, 10 to 25 percent slopes	2,625	0.2

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
69	Razorba channery sandy loam, 30 to 75 percent slopes	7,090	0.4
70	Redcreek-Rentsac complex, 5 to 30 percent slopes	41,876	2.5
71	Redrob loam	3,785	0.2
72	Redrob Variant loam	986	0.1
73	Rentsac channery loam, 5 to 50 percent slopes	228,731	13.5
74	Rentsac-Moyerson-Rock outcrop complex, 5 to 65 percent slopes	285,289	16.7
75	Rentsac-Piceance complex, 2 to 30 percent slopes	26,270	1.6
76	Rhone loam, 30 to 75 percent slopes	11,969	0.7
77	Rhone-Northwater-Lamphier loams, 3 to 50 percent slopes	9,521	0.6
78	Rock outcrop	31,712	1.9
79	Shawa loam, 1 to 3 percent slopes	2,200	0.1
80	Shawa loam, 3 to 8 percent slopes	4,945	0.3
81	Shawa loam, wet, 0 to 5 percent slopes	2,183	0.1
82	Silas loam, 0 to 8 percent slopes	4,638	0.3
83	Silas loam, 8 to 12 percent slopes	512	*
84	Silas Variant loam	712	*
85	Sinkson gravelly sandy loam, 1 to 8 percent slopes	852	0.1
86	Sinkson gravelly sandy loam, 8 to 15 percent slopes	522	*
87	Starman-Vandamore complex, 5 to 40 percent slopes	14,478	0.9
88	Tampico-Miracle complex, 8 to 50 percent slopes	22,707	1.3
89	Tisworth fine sandy loam, 0 to 5 percent slopes	10,510	0.6
90	Torrifluvents, gullied	8,168	0.5
91	Torriorthents-Rock outcrop complex, 15 to 90 percent slopes	139,508	8.2
92	Trembles loam, wet	1,202	0.1
93	Turley fine sandy loam, 0 to 3 percent slopes	4,486	0.3
94	Turley fine sandy loam, 3 to 8 percent slopes	9,763	0.6
95	Uffens loam, 0 to 5 percent slopes	4,306	0.3
96	Veatch channery loam, 12 to 50 percent slopes	25,063	1.5
97	Walknolls channery sandy loam, 5 to 50 percent slopes	6,281	0.4
98	Waybe-Vandamore Variant-Rock outcrop complex, 5 to 30 percent slopes	2,452	0.1
99	Winnemucca-Clayburn loams, 8 to 25 percent slopes	13,098	0.8
100	Work loam, 1 to 3 percent slopes	1,568	0.1
101	Work loam, 3 to 8 percent slopes	5,515	0.3
102	Work loam, 8 to 15 percent slopes	3,162	0.2
103	Work loam, 15 to 25 percent slopes	292	*
104	Yamac loam, 2 to 15 percent slopes	17,977	1.1
105	Zoltay clay loam, 1 to 3 percent slopes	297	*
106	Zoltay clay loam, 3 to 8 percent slopes	7,225	0.4
107	Zoltay clay loam, 8 to 15 percent slopes	7,342	0.4
108	Zoltay clay loam, 15 to 25 percent slopes	3,634	0.2
	Water	3,378	0.2
	Total	1,693,700	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. Only the soils suited to crops are listed]

Soil name and map symbol	Alfalfa hay		Grass-legume hay		Grass hay		Barley		Winter wheat		Spring wheat	
	N	I	N	I	N	I	N	I	N	I	N	I
	Ton	Ton	Ton	Ton	Ton	Ton	Bu	Bu	Bu	Bu	Bu	Bu
3---------- Absher	---	2.5	---	2.0	---	1.5	52	---	28	---	30	---
4---------- Absher	---	2.5	---	2.0	---	1.5	50	---	25	---	28	---
7---------- Billings	---	3.5	---	2.5	---	---	60	---	---	---	---	---
13---------- Bulkley	---	2.5	---	2.0	---	1.5	58	---	27	---	28	---
14---------- Bulkley-Abor	---	2.5	---	2.0	---	1.5	58	---	27	---	28	---
25---------- Colorow	---	3.5	---	2.5	---	2.0	60	---	---	---	---	---
29---------- Dollard	---	3.0	---	2.5	---	2.0	55	---	24	---	26	---
30---------- Dollard	---	2.5	---	2.0	---	1.5	52	---	20	---	22	---
33---------- Forelle	---	3.0	---	2.5	---	2.0	62	---	25	---	28	---
34---------- Forelle	---	3.0	---	2.5	---	2.0	62	---	25	---	28	---
38, 39---------- Guben	---	2.5	---	2.0	---	1.5	60	---	24	---	26	---
40---------- Hagga	---	---	---	2.0	---	3.0	---	---	---	---	---	---
41---------- Havre	---	3.0	---	2.5	---	2.0	---	---	---	---	---	---
46---------- Kinnear	---	3.0	---	2.5	---	2.0	---	65	---	---	---	---
47---------- Kobar	---	2.5	---	2.0	---	1.5	58	---	28	---	30	---
48---------- Kobar	---	2.5	---	2.0	---	1.5	58	---	28	---	30	---
49---------- Kobar	---	2.0	---	1.5	---	1.0	52	---	25	---	26	---
60, 61---------- Patent	---	3.0	---	2.5	---	2.0	60	---	28	---	30	---
62---------- Patent	---	2.5	---	2.0	---	2.0	57	---	25	---	27	---
65---------- Pinelli	---	2.5	---	2.0	---	1.5	58	---	27	---	28	---

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Alfalfa hay		Grass-legume hay		Grass hay		Barley		Winter wheat		Spring wheat	
	N	I	N	I	N	I	N	I	N	I	N	I
	Ton	Ton	Ton	Ton	Ton	Ton	Bu	Bu	Bu	Bu	Bu	Bu
71--- Redrob	---	2.5	---	2.5	---	3.0	60	---	---	---	---	---
72--- Redrob Variant	---	---	---	2.0	---	2.5	---	---	---	---	---	---
79--- Shawa	---	3.5	---	3.0	---	2.5	60	---	30	---	32	---
80--- Shawa	---	3.5	---	3.0	---	2.5	60	---	30	---	32	---
81--- Shawa	---	2.5	---	2.5	---	3.0	---	---	---	---	---	---
85--- Sinkson	---	2.5	---	2.0	---	1.5	55	---	---	---	---	---
89--- Tisworth	---	2.5	---	2.0	---	1.5	58	---	---	---	---	---
92--- Trembles	---	3.5	---	3.0	---	2.5	55	---	---	---	---	---
93--- Turley	---	3.5	---	3.0	---	2.5	60	---	---	---	---	---
94--- Turley	---	3.5	---	3.0	---	2.5	60	---	---	---	---	---
95--- Uffens	---	2.5	---	2.0	---	1.5	55	---	---	---	---	---
100, 101--- Work	---	3.0	---	2.5	---	2.0	62	---	25	---	28	---
102--- Work	---	2.5	---	2.0	---	1.5	58	---	25	---	28	---
105--- Zoltay	---	3.0	---	2.5	---	2.0	62	---	25	---	28	---
106--- Zoltay	---	3.0	---	2.5	---	2.0	62	---	25	---	28	---
107--- Zoltay	---	2.5	---	2.0	---	1.5	58	---	25	---	28	---

TABLE 6.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1---------- Abor	Poor	Fair	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
2*:												
Absarokee---------	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Delson----------	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
3, 4---------- Absher	Poor	Poor	Very poor.	---	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.	Very poor.
5*. Badland												
6---------- Barcus	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
7---------- Billings	Fair	Fair	Good	---	Good	Good	Poor	Very poor.	Fair	Fair	Very poor.	Fair.
8*:												
Billings----------	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
Torrifluvents.												
9*:												
Blakabin----------	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Rhone----------	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Good.
Waybe----------	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
10*:												
Blazon----------	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
Rentsac----------	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
11*:												
Borollic Calciorthids.												
Guben----------	Poor	Fair	Fair	---	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
12*:												
Bucklon----------	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Inchau----------	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
13---------- Bulkley	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.

See footnote at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
14*:												
Bulkley	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Abor	Poor	Fair	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
15--Castner	Poor	Poor	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
16, 17--Chipeta	Very poor.	Very poor.	Very poor.	---	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
18*:												
Chipeta	Very poor.	Very poor.	Very poor.	---	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Killpack	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor.
19*:												
Chipeta	Very poor.	Very poor.	Very poor.	---	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Walknolls	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
20--Clayburn	Very poor.	Very poor.	Good	---	---	Good	Poor	Very poor.	Poor	---	Very poor.	Good.
21*:												
Cliffdown	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
Cliffdown Variant-	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
22--Clifterson	Poor	Poor	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
23--Cochetopa	Poor	Poor	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
24*:												
Cochetopa	Poor	Poor	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Jerry	Poor	Poor	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
25--Colorow	Good	Good	---	---	---	---	---	---	Good	---	---	---
26*:												
Cowdrey	Very poor.	Very poor.	Good	---	Good	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	---
Tampico	Very poor.	Fair	Fair	---	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
27--Curecanti	Poor	Poor	Fair	---	---	Fair	Poor	Very poor.	Poor	---	Very poor.	Fair.
28*:												
Delson	Very poor.	Very poor.	Good	---	---	Good	Very poor.	Very poor.	Very poor.	---	Very poor.	Good.

See footnote at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
28*: Perma	Very poor.	Very poor.	Fair	---	Fair	Good	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
29, 30, 31--- Dollard	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
32*. Fluvaquents												
33, 34--- Forelle	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
35*: Gaynor	Poor	Poor	Fair	---	---	Fair	Poor	Very poor.	Poor	---	Very poor.	Fair.
Midway	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
36--- Glendive	Fair	Good	Fair	---	---	Fair	Good	Poor	Fair	Good	Poor	Fair.
37--- Glenton	Poor	Poor	Fair	---	---	Fair	Poor	Poor	Poor	---	Poor	Fair.
38, 39--- Guben	Poor	Fair	Fair	---	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
40--- Hagga	Poor	Fair	Fair	---	---	Poor	Fair	Fair	Fair	Very poor.	Fair	Poor.
41--- Havre	Good	Good	Fair	Good	---	Fair	Good	Fair	Good	Good	Fair	Fair.
42--- Irigul	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
43*: Irigul	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Parachute	Poor	Poor	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
44--- Jerry	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
45*: Jerry	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Thornburgh	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Rhone	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Good.
46--- Kinnear	Poor	Poor	Poor	---	---	Poor	Poor	Very poor.	Poor	---	Very poor.	Poor.
47, 48--- Kobar	Fair	Good	Fair	---	Good	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
49--- Kobar	Fair	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.

See footnote at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
50*:												
Lamphier	Poor	Poor	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Tampico	Very poor.	Fair	Fair	---	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
Kamack	Very poor.	Very poor.	Good	---	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Good.
51*:												
Mergel	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Redthayne	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Very poor.	---	Very poor.	Fair.
Dollard	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
52--Miracle	Poor	Poor	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
53--Moyerson	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
54*:												
Nagitsy	Poor	Fair	Fair	---	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Irigul	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
55--Nihill	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
56--Northwater	Poor	Poor	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
57*:												
Owen Creek	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Jerry	Poor	Poor	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Burnette	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
58--Parachute	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
59*:												
Parachute	Poor	Poor	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Rhone	Poor	Poor	Good	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Good.
60, 61--Patent	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	---
62, 63--Patent	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
64--Piceance	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.

See footnote at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
65---------- Pinelli	Poor	Poor	Fair	---	---	Fair	Poor	Very poor.	Poor	---	Very poor.	Fair.
66*:												
Potts----------	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Begay----------	Poor	Fair	Fair	---	Poor	Fair	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
67---------- Rabbitex	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
68*:												
Rabbitex----------	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Work----------	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
69---------- Razorba	Very poor.	Very poor.	Good	---	Good	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.	---
70*:												
Redcreek----------	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Rentsac----------	Poor	Poor	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
71---------- Redrob	Fair	Fair	Good	---	---	Good	Good	Good	Fair	Good	Good	Fair.
72---------- Redrob Variant	Poor	Poor	Good	---	---	Good	Good	Good	Fair	---	Good	Good.
73---------- Rentsac	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
74*:												
Rentsac----------	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
Moyerson----------	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
Rock outcrop.												
75*:												
Rentsac----------	Poor	Poor	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
Piceance----------	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
76---------- Rhone	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Good.
77*:												
Rhone----------	Very poor.	Very poor.	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Good.
Northwater--------	Poor	Poor	Good	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Lamphier----------	Poor	Poor	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.

See footnote at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
78*. Rock outcrop												
79, 80---------- Shawa	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
81---------- Shawa	Fair	Fair	Good	---	---	Fair	Good	Good	Fair	---	Good	Fair.
82, 83---------- Silas	Poor	Poor	Good	Good	---	Good	Poor	Very poor.	Poor	---	Very poor.	Good.
84---------- Silas Variant	Good	Good	Good	---	---	Good	Good	Poor	Good	---	Fair	Good.
85---------- Sinkson	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	---
86---------- Sinkson	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
87*: Starman----------	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
Vandamore---------	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
88*: Tampico----------	Very poor.	Fair	Fair	---	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
Miracle----------	Poor	Poor	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
89---------- Tisworth	Very poor.	Very poor.	Poor	---	---	Poor	Poor	Very poor.	Very poor.	---	Very poor.	Poor.
90*. Torrifluvents												
91*: Torriorthents.												
Rock outcrop.												
92---------- Trembles	Fair	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
93, 94---------- Turley	Fair	Good	Poor	---	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Poor.
95---------- Uffens	Very poor.	Very poor.	Very poor.	---	---	Very poor.	Poor	Very poor.	Very poor.	---	Very poor.	Very poor.
96---------- Veatch	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Poor	---	Very poor.	Good.
97---------- Walknolls	Very poor.	Very poor.	Poor	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor.
98*: Waybe----------	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.

See footnote at end of table.

TABLE 6.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
98*:												
Vandamore Variant-	Very poor.	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Rock outcrop.												
99*:												
Winnemucca	Poor	Fair	Good	---	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Good.
Clayburn	Very poor.	Very poor.	Good	---	---	Good	Poor	Very poor.	Poor	---	Very poor.	Good.
100, 101 Work	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
102 Work	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
103 Work	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
104 Yamac	Fair	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
105, 106 Zoltay	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	---
107, 108 Zoltay	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Septic tank absorption fields	Local roads and streets
1---- Abor	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
2*: Absarokee----	Severe: slope, depth to rock, too clayey.	Severe: slope, shrink-swell, low strength.	Severe: slope, depth to rock, shrink-swell.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, low strength.	Severe: low strength, slope, shrink-swell.
Delson----	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
3, 4---- Absher	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: excess salt, droughty.
5*. Badland						
6---- Barcus	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Severe: droughty.
7---- Billings	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Moderate: excess salt.
8*: Billings----	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Moderate: excess salt.
Torrifluvents.						
9*: Blakabin----	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Rhone----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Waybe----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: large stones, slope, thin layer.
10*: Blazon----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Rentsac----	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: thin layer, slope.
11*: Borollic Calciorthids.						

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Septic tank absorption fields	Local roads and streets
11*:						
Guben	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty.
12*:						
Bucklon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Inchau	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
13--- Bulkley	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
14*:						
Bulkley	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Abor	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
15--- Castner	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
16, 17--- Chipeta	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: excess salt, thin layer.
18*:						
Chipeta	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: excess salt, thin layer.
Killpack	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Moderate: excess salt, thin layer.
19*:						
Chipeta	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: excess salt, thin layer.
Walknolls	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: thin layer.
20--- Clayburn	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: slope.
21*:						
Cliffdown	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: small stones, droughty.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Septic tank absorption fields	Local roads and streets
21*: Cliffdown Variant	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.
22---- Clifterson	Moderate: large stones, slope.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Moderate: slope, large stones.	Severe: large stones, droughty.
23---- Cochetopa	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
24*: Cochetopa--------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Jerry----------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
25---- Colorow	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
26*: Cowdrey----------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Tampico----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
27---- Curecanti	Severe: cutbanks cave, large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.	Severe: large stones.
28*: Delson----------	Moderate: too clayey, large stones, slope.	Severe: shrink-swell.	Moderate: slope, shrink-swell, large stones.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: large stones, slope.
Perma----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, small stones.
29---- Dollard	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: thin layer.
30---- Dollard	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope, thin layer.
31---- Dollard	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Septic tank absorption fields	Local roads and streets
32*: Fluvaquents						
33--- Forelle	Slight	Slight	Slight	Moderate: slope.	Slight	Moderate: large stones.
34--- Forelle	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: large stones, slope.
35*: Gaynor	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope, thin layer.
Midway	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: thin layer.
36--- Glendive	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
37--- Glenton	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
38--- Guben	Slight	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
39--- Guben	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
40--- Hagga	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
41--- Havre	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
42--- Irigul	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
43*: Irigul	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
Parachute	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
44--- Jerry	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
45*: Jerry	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Septic tank absorption fields	Local roads and streets
45*:						
Thornburgh	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rhone	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
46 Kinnear	Slight	Slight	Slight	Slight	Slight	Slight.
47, 48 Kobar	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
49 Kobar	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
50*:						
Lamphier	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tampico	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Kamack	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
51*:						
Mergel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Redthayne	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Dollard	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
52 Miracle	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.	Moderate: slope, thin layer.
53 Moyerson	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope, thin layer.
54*:						
Nagitsy	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
Irigul	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, thin layer.
55 Nihill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
56 Northwater	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Septic tank absorption fields	Local roads and streets
57*:						
Owen Creek	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope, thin layer.
Jerry	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Burnette	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
58--- Parachute	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
59*:						
Parachute	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rhone	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
60--- Patent	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
61--- Patent	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
62--- Patent	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
63--- Patent	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
64--- Piceance	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: slope, thin layer.
65--- Pinelli	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.	Slight.
66*:						
Potts	Slight	Slight	Slight	Moderate: slope.	Slight	Slight.
Begay	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
67--- Rabbitex	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
68*:						
Rabbitex	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Work	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
69--- Razorba	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Septic tank absorption fields	Local roads and streets
70*:						
Redcreek	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
Rentsac	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: thin layer, slope.
71 Redrob	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Moderate: wetness, flooding.	Moderate: wetness.
72 Redrob Variant	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Moderate: droughty.
73 Rentsac	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: thin layer, slope.
74*:						
Rentsac	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: thin layer, slope.
Moyerson	Severe: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: depth to rock, slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: large stones, slope, thin layer.
Rock outcrop.						
75*:						
Rentsac	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: thin layer, slope.
Piceance	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: slope, thin layer.
76 Rhone	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
77*:						
Rhone	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Northwater	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lamphier	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
78*. Rock outcrop						
79 Shawa	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
80 Shawa	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Slight.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Septic tank absorption fields	Local roads and streets
81---------- Shawa	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: excess salt, flooding.
82---------- Silas	Moderate: wetness.	Slight---------	Moderate: wetness.	Moderate: slope.	Moderate: frost action.	Moderate: large stones.
83---------- Silas	Moderate: wetness, slope.	Moderate: slope.	Moderate: wetness, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: large stones, slope.
84---------- Silas Variant	Moderate: wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
85---------- Sinkson	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: small stones.
86---------- Sinkson	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
87*: Starman----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: small stones, thin layer.
Vandamore--------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
88*: Tampico----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Miracle----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope.
89---------- Tisworth	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Severe: excess salt.
90*. Torrifluvents						
91*: Torriorthents. Rock outcrop.						
92---------- Trembles	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
93---------- Turley	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
94---------- Turley	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
95---------- Uffens	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: excess salt, droughty.
96---------- Veatch	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 7.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Septic tank absorption fields	Local roads and streets
97---------- Walknolls	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
98*:						
Waybe----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: large stones, slope, thin layer.
Vandamore Variant	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope, thin layer.
Rock outcrop.						
99*:						
Winnemucca-------	Severe: large stones, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: low strength, slope, large stones.	Severe: slope.
Clayburn---------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: slope.
100---------- Work	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action, shrink-swell.	Slight.
101---------- Work	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, frost action, shrink-swell.	Slight.
102---------- Work	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
103---------- Work	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
104---------- Yamac	Severe: cutbanks cave.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.	Moderate: slope.
105, 106---------- Zoltay	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
107---------- Zoltay	Moderate: too clayey, slope.	Severe: shrink-swell.	Moderate: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
108---------- Zoltay	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1---------- Abor	Severe: slope.	Severe: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
2*: Absarokee-------- Delson----------	Severe: slope. Severe: slope.	Severe: thin layer. Moderate: piping, large stones.	Complex slope, percs slowly, depth to rock. Deep to water	Complex slope, percs slowly, rooting depth. Percs slowly, slope.	Slope, depth to rock, percs slowly. Slope, large stones.	Slope, percs slowly, rooting depth. Large stones, slope, percs slowly.
3---------- Absher	Slight---------	Severe: excess salt.	Deep to water	Droughty, percs slowly.	Erodes easily, percs slowly.	Excess salt, erodes easily, droughty.
4---------- Absher	Moderate: slope.	Severe: excess salt.	Deep to water	Droughty, percs slowly.	Erodes easily, percs slowly.	Excess salt, erodes easily, droughty.
5*. Badland						
6---------- Barcus	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, fast intake, slope.	Too sandy------	Droughty.
7---------- Billings	Slight---------	Moderate: piping.	Deep to water	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Excess salt, erodes easily, percs slowly.
8*: Billings--------- Torrifluvents.	Slight---------	Moderate: piping.	Deep to water	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Excess salt, erodes easily, percs slowly.
9*: Blakabin--------- Rhone---------- Waybe----------	Severe: slope. Severe: slope. Severe: depth to rock, slope.	Slight--------- Severe: thin layer. Severe: thin layer.	Deep to water Deep to water Deep to water	Percs slowly, slope. Slope---------- Percs slowly, depth to rock, slope.	Slope, percs slowly. Slope---------- Slope, large stones, depth to rock.	Slope, percs slowly. Slope. Large stones, slope, erodes easily.
10*: Blazon---------- Rentsac----------	Severe: depth to rock, slope. Severe: depth to rock, slope.	Moderate: piping. Severe: seepage, large stones.	Deep to water Deep to water	Depth to rock, slope. Large stones, droughty, depth to rock.	Slope, depth to rock. Slope, large stones, depth to rock.	Slope, depth to rock. Large stones, slope, droughty.
11*: Borollic Calciorthids. Guben----------	Severe: slope.	Moderate: large stones.	Deep to water	Droughty, soil blowing, slope.	Slope, large stones, soil blowing.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
12*:						
Bucklon	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Inchau	Severe: slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
13--- Bulkley	Severe: slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope, excess salt.	Slope, large stones, percs slowly.	Large stones, slope, percs slowly.
14*:						
Bulkley	Severe: slope.	Severe: hard to pack.	Deep to water	Percs slowly, slope, excess salt.	Slope, large stones, percs slowly.	Large stones, slope, percs slowly.
Abor	Severe: slope.	Severe: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
15--- Castner	Severe: depth to rock, slope.	Severe: seepage.	Deep to water	Large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
16, 17--- Chipeta	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, excess salt, erodes easily.
18*:						
Chipeta	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, excess salt, erodes easily.
Killpack	Moderate: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock, erodes easily.	Excess salt, erodes easily.
19*:						
Chipeta	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, excess salt, erodes easily.
Walknolls	Severe: depth to rock, slope.	Severe: seepage.	Deep to water	Droughty, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
20--- Clayburn	Severe: slope.	Severe: piping.	Deep to water	Slope---	Slope---	Slope.
21*:						
Cliffdown	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope, excess salt.	Too sandy---	Droughty.
Cliffdown Variant	Severe: slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
22--- Clifterson	Severe: seepage, slope.	Severe: seepage.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
23--- Cochetopa	Severe: slope.	Moderate: hard to pack, large stones.	Deep to water	Percs slowly, slope.	Slope, large stones, percs slowly.	Large stones, slope, percs slowly.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
24*:						
Cochetopa	Severe: slope.	Moderate: hard to pack, large stones.	Deep to water	Percs slowly, slope.	Slope, large stones, percs slowly.	Large stones, slope, percs slowly.
Jerry	Severe: slope.	Severe: thin layer.	Deep to water	Percs slowly, slope.	Slope, large stones.	Large stones, slope, percs slowly.
25--- Colorow	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
26*:						
Cowdrey	Severe: slope.	Moderate: hard to pack.	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
Tampico	Severe: slope.	Slight---	Deep to water	Slope---	Slope, erodes easily.	Slope, erodes easily.
27--- Curecanti	Severe: seepage.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Large stones, too sandy.	Large stones, droughty.
28*:						
Delson	Severe: slope.	Moderate: large stones.	Deep to water	Large stones, percs slowly, slope.	Slope, large stones.	Large stones, slope, percs slowly.
Perma	Severe: slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
29--- Dollard	Moderate: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
30, 31--- Dollard	Severe: slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
32*. Fluvaquents						
33--- Forelle	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope---	Favorable---	Favorable.
34--- Forelle	Severe: slope.	Severe: piping.	Deep to water	Slope---	Slope---	Slope.
35*:						
Gaynor	Severe: slope.	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
36--- Glendive	Severe: seepage.	Severe: piping.	Deep to water	Slope, excess salt.	Soil blowing---	Favorable.
37--- Glenton	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, flooding.	Too sandy, soil blowing.	Favorable.
38--- Guben	Moderate: seepage.	Moderate: large stones.	Deep to water	Droughty, soil blowing.	Large stones, soil blowing.	Large stones, droughty.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
39---------- Guben	Moderate: seepage, slope.	Moderate: large stones.	Deep to water	Droughty, soil blowing, slope.	Large stones, soil blowing.	Large stones, droughty.
40---------- Hagga	Slight---------	Severe: wetness.	Frost action, cutbanks cave.	Wetness--------	Wetness--------	Wetness.
41---------- Havre	Moderate: seepage.	Severe: piping.	Deep to water	Excess salt----	Erodes easily	Erodes easily.
42---------- Irigul	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
43*: Irigul----------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
Parachute--------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
44---------- Jerry	Severe: slope.	Severe: thin layer.	Deep to water	Percs slowly, slope.	Slope, large stones.	Large stones, slope, percs slowly.
45*: Jerry----------	Severe: slope.	Severe: thin layer.	Deep to water	Percs slowly, slope.	Slope, large stones.	Large stones, slope, percs slowly.
Thornburgh-------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
Rhone----------	Severe: slope.	Severe: thin layer.	Deep to water	Slope----------	Slope----------	Slope.
46---------- Kinnear	Moderate: seepage, slope.	Severe: piping.	Slope----------	Slope----------	Favorable------	Favorable.
47---------- Kobar	Slight---------	Slight---------	Deep to water	Percs slowly---	Erodes easily, percs slowly.	Erodes easily, percs slowly.
48---------- Kobar	Moderate: slope.	Slight---------	Deep to water	Percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
49---------- Kobar	Severe: slope.	Slight---------	Deep to water	Percs slowly, slope.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
50*: Lamphier---------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Slope.
Tampico----------	Severe: slope.	Slight---------	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Kamack----------	Severe: seepage, slope.	Severe: thin layer.	Deep to water	Slope----------	Slope, large stones.	Large stones, slope, droughty.
51*: Mergel----------	Severe: slope.	Moderate: large stones.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
51*:						
Redthayne	Severe: slope.	Slight	Deep to water	Slope	Slope	Slope.
Dollard	Severe: slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
52--- Miracle	Severe: slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
53--- Moyerson	Severe: depth to rock, slope.	Moderate: hard to pack, large stones.	Deep to water	Percs slowly, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
54*:						
Nagitsy	Severe: slope.	Moderate: thin layer, seepage, large stones.	Deep to water	Droughty, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Irigul	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
55--- Nihill	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope	Slope, droughty.
56--- Northwater	Severe: slope.	Severe: thin layer.	Deep to water	Slope	Slope	Slope.
57*:						
Owen Creek	Severe: slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock.	Slope, depth to rock, percs slowly.
Jerry	Severe: slope.	Severe: thin layer.	Deep to water	Percs slowly, slope.	Slope, large stones.	Large stones, slope, percs slowly.
Burnette	Severe: slope.	Slight	Deep to water	Percs slowly, slope, erodes easily.	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
58--- Parachute	Severe: seepage, slope.	Severe: seepage.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
59*:						
Parachute	Severe: seepage, slope.	Severe: seepage.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Rhone	Severe: slope.	Severe: thin layer.	Deep to water	Slope	Slope	Slope.
60--- Patent	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
61--- Patent	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
62, 63--- Patent	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope	Slope.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
64---------- Piceance	Severe: slope.	Severe: seepage.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
65---------- Pinelli	Moderate: slope.	Moderate: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
66*: Potts----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
Begay----------	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
67---------- Rabbitex	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Slope.
68*: Rabbitex---------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Slope.
Work----------	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
69---------- Razorba	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope----------	Slope, droughty.
70*: Redcreek---------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Rentsac----------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
71---------- Redrob	Severe: seepage.	Severe: seepage, wetness.	Large stones, cutbanks cave.	Wetness--------	Large stones, wetness, too sandy.	Wetness.
72---------- Redrob Variant	Severe: seepage.	Severe: seepage.	Large stones, cutbanks cave.	Wetness, droughty.	Large stones, wetness, too sandy.	Large stones, droughty.
73---------- Rentsac	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
74*: Rentsac----------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Moyerson---------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Rock outcrop.						
75*: Rentsac----------	Severe: depth to rock, slope.	Severe: seepage, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Piceance---------	Severe: slope.	Severe: seepage.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
76---------- Rhone	Severe: slope.	Severe: thin layer.	Deep to water	Slope----------	Slope----------	Slope.
77*:						
Rhone----------	Severe: slope.	Severe: thin layer.	Deep to water	Slope----------	Slope----------	Slope.
Northwater-------	Severe: slope.	Severe: thin layer.	Deep to water	Slope----------	Slope----------	Slope.
Lamphier---------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Slope.
78*. Rock outcrop						
79---------- Shawa	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
80---------- Shawa	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Favorable.
81---------- Shawa	Moderate: seepage.	Severe: piping.	Flooding, frost action.	Wetness, flooding.	Wetness--------	Excess salt.
82---------- Silas	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Favorable.
83---------- Silas	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Slope.
84---------- Silas Variant	Slight---------	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
85---------- Sinkson	Moderate: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
86---------- Sinkson	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
87*:						
Starman----------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
Vandamore--------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
88*:						
Tampico----------	Severe: slope.	Slight---------	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Miracle----------	Severe: slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
89---------- Tisworth	Moderate: slope.	Severe: excess salt.	Deep to water	Droughty, soil blowing, percs slowly.	Erodes easily, soil blowing.	Excess salt, erodes easily.
90*. Torrifluvents						

See footnote at end of table.

TABLE 8.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
91*: Torriorthents. Rock outcrop.						
92---- Trembles	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, flooding.	Soil blowing---	Favorable.
93---- Turley	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Erodes easily.
94---- Turley	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
95---- Uffens	Slight---------	Severe: excess salt.	Deep to water	Droughty-------	Favorable------	Excess salt, droughty.
96---- Veatch	Severe: seepage, slope.	Severe: seepage.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
97---- Walknolls	Severe: depth to rock, slope.	Severe: seepage.	Deep to water	Droughty, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
98*: Waybe----------	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.
Vandamore Variant	Severe: seepage, slope.	Severe: seepage.	Deep to water	Depth to rock, slope.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Rock outcrop.						
99*: Winnemucca-------	Severe: slope.	Severe: piping, large stones.	Deep to water	Large stones, droughty, percs slowly.	Slope, large stones.	Large stones, slope, droughty.
Clayburn---------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope----------	Slope.
100---- Work	Slight---------	Severe: piping.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
101---- Work	Moderate: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
102, 103---------- Work	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
104---- Yamac	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
105---- Zoltay	Slight---------	Moderate: piping, large stones.	Deep to water	Percs slowly---	Large stones---	Large stones, percs slowly.
106---- Zoltay	Moderate: slope.	Moderate: piping, large stones.	Deep to water	Percs slowly, slope.	Large stones---	Large stones, percs slowly.
107, 108---------- Zoltay	Severe: slope.	Moderate: piping, large stones.	Deep to water	Percs slowly, slope.	Slope, large stones.	Large stones, slope, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1----------	0-4	Clay loam--------	CL	A-6, A-7	0	80-100	75-100	65-100	60-90	35-45	15-25
Abor	4-33	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	80-100	75-100	65-100	60-95	35-65	20-45
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
2*:											
Absarokee-------	0-4	Channery loam----	CL-ML, GM-GC	A-4	0-5	65-85	55-75	50-70	35-55	20-30	5-10
	4-22	Clay, clay loam, channery clay loam.	CL, CH, SC	A-7	0-5	75-95	50-95	45-95	35-90	45-60	20-35
	22-26	Weathered bedrock	---	---	---	---	---	---	---	---	---
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Delson----------	0-7	Channery loam----	GM-GC, CL-ML	A-2, A-4	0-10	50-75	50-75	40-70	30-65	20-30	5-10
	7-60	Clay loam, clay	CL, CH	A-6, A-7	5-25	85-100	85-100	75-100	65-85	35-55	15-30
3, 4----------	0-3	Loam----------	CL-ML	A-4	0	95-100	75-100	65-90	50-80	20-30	5-10
Absher	3-13	Silty clay, clay.	CL, CH	A-7	0	95-100	75-100	70-100	60-95	40-60	20-40
	13-60	Clay loam, clay, silty clay.	CL, CH	A-7	0	95-100	75-100	70-100	60-95	40-55	20-35
5*.											
Badland											
6----------	0-6	Channery loamy sand.	SM, GM	A-2, A-1	0-5	55-80	50-75	25-50	15-30	---	NP
Barcus	6-16	Channery sand----	GM, SM	A-1	0-5	50-75	50-65	20-45	10-20	---	NP
	16-60	Stratified very channery sand to very channery loamy fine sand.	GP-GM	A-1	0-10	30-55	20-45	10-35	5-10	---	NP
7----------	0-6	Silty clay loam	CL	A-6	0	100	100	95-100	90-95	30-40	10-20
Billings	6-60	Silty clay loam, clay loam.	CL	A-6	0	100	100	95-100	90-95	30-40	10-20
8*:											
Billings--------	0-2	Silty clay loam	CL	A-6	0	100	100	95-100	90-95	30-40	10-20
	2-60	Silty clay loam, clay loam.	CL	A-6	0	100	100	95-100	90-95	30-40	10-20
Torrifluvents.											
9*:											
Blakabin--------	0-3	Clay loam--------	CL	A-6	0	80-100	75-100	60-90	60-85	30-40	10-20
	3-32	Clay loam, clay, silty clay loam.	CL	A-6, A-7	0	80-100	75-100	60-90	60-90	35-50	15-25
	32-50	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	85-100	75-100	60-90	55-90	35-50	15-25
	50-60	Clay loam--------	CL	A-6, A-7	0	85-100	75-100	65-90	50-70	30-45	10-25
Rhone-----------	0-24	Loam----------	CL, CL-ML	A-4, A-6	0	90-100	80-95	70-90	50-70	20-35	5-15
	24-50	Channery sandy clay loam, very channery sandy clay loam, very channery loam.	GM-GC	A-2	0-10	45-60	40-55	30-50	15-35	20-30	5-10
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
9*:											
Waybe	0-4	Flaggy clay loam	CL	A-6	25-40	85-100	85-100	85-100	70-80	30-40	10-20
	4-19	Silty clay loam, channery silty clay loam, clay.	CL	A-6, A-7	0-10	75-100	70-100	65-100	60-95	30-45	10-25
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
10*:											
Blazon	0-4	Channery loam	GM	A-6	5-10	55-70	55-70	50-65	40-50	35-40	10-15
	4-16	Channery clay loam, shaly clay loam.	---	---	5-10	55-70	55-70	50-65	40-50	35-40	10-15
	16	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rentsac	0-5	Very channery loam.	SM, GM	A-2, A-1	15-30	45-70	35-60	25-45	15-35	15-25	NP-5
	5-16	Very channery loam, very channery sandy loam, very flaggy loam.	SM, GM	A-2, A-4, A-1	15-50	40-75	30-65	15-45	10-40	15-25	NP-5
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
11*:											
Borollic Calciorthids.											
Guben	0-11	Loam	CL-ML	A-4	0	100	95-100	90-95	50-80	20-30	5-10
	11-15	Very gravelly sandy clay loam, very gravelly clay loam, gravelly loam.	GM-GC, GC	A-2, A-4, A-6	10-15	35-55	30-50	25-45	15-40	25-40	5-20
	15-23	Very gravelly sandy clay loam, very gravelly loam, extremely gravelly sandy loam.	GM-GC, GC	A-2	15-30	30-40	25-35	15-30	10-25	25-35	5-15
	23-60	Very cobbly sandy loam.	GM-GC, GC	A-2	25-45	45-65	40-60	30-50	10-35	25-30	5-10
12*:											
Bucklon	0-10	Loam	CL	A-6	0	95-100	95-100	80-100	60-80	25-35	10-15
	10-17	Clay loam, loam	CL	A-6	0	80-100	75-95	65-95	50-85	25-40	10-20
	17	Weathered bedrock	---	---	---	---	---	---	---	---	---
Inchau	0-11	Loam	CL-ML, ML	A-4	0	75-100	75-100	70-90	50-70	25-35	5-10
	11-35	Gravelly loam, gravelly clay loam, clay loam.	GM-GC, GC, CL	A-4, A-6	0-10	55-85	50-85	45-80	35-60	25-35	5-15
	35	Weathered bedrock	---	---	---	---	---	---	---	---	---
13 Bulkley	0-5	Channery silty clay loam.	CL, SC, GC	A-6	0-10	60-80	50-75	40-70	45-60	30-40	10-20
	5-20	Silty clay, clay, silty clay loam.	CH	A-7	0-10	100	95-10	90-100	90-95	55-70	30-45
	20-48	Clay loam, silty clay loam.	CL, CH	A-7	0-50	100	95-100	80-100	60-85	40-60	20-40
	48	Weathered bedrock	---	---	---	---	---	---	---	---	---
14*:											
Bulkley	0-3	Clay loam	CL	A-7, A-6	0	100	95-100	95-100	75-95	30-50	15-30
	3-58	Silty clay, clay, silty clay loam.	CH	A-7	0-10	100	95-10	90-100	90-95	55-70	30-45
	58	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
14*:											
Abor	0-4	Clay loam	CL	A-6, A-7	0	80-100	75-100	65-100	60-90	35-45	15-25
	4-33	Silty clay, clay.	CL, CH	A-6, A-7	0	80-100	75-100	65-100	60-95	35-65	20-45
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
15	0-7	Channery loam	ML, CL-ML, SM, GM	A-4	0-15	60-90	50-80	40-70	35-60	20-30	NP-10
Castner	7-11	Very channery loam, very cobbly loam, very channery sandy loam.	GM, GM-GC	A-2, A-1, A-4	10-30	30-65	20-55	15-45	10-40	20-30	NP-10
	11-17	Very channery loam, very channery sandy loam, very flaggy loam.	GM, GM-GC, GP-GM	A-2, A-1	25-40	25-60	15-50	10-40	5-35	20-30	NP-10
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
16	0-3	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	90-95	35-45	10-20
Chipeta	3-18	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	90-95	35-50	15-25
	18	Weathered bedrock	---	---	---	---	---	---	---	---	---
17	0-2	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	90-95	35-45	10-20
Chipeta	2-12	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	90-95	35-50	15-25
	12	Weathered bedrock	---	---	---	---	---	---	---	---	---
18*:											
Chipeta	0-3	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	90-95	35-45	10-20
	3-18	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	90-95	35-50	15-25
	18	Weathered bedrock	---	---	---	---	---	---	---	---	---
Killpack	0-4	Silty clay loam	CL	A-6	0	100	100	95-100	85-95	30-40	10-20
	4-30	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	95-100	95-100	85-95	35-45	15-25
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---
19*:											
Chipeta	0-5	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	90-95	35-45	10-20
	5-12	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	90-95	35-50	15-25
	12	Weathered bedrock	---	---	---	---	---	---	---	---	---
Walknolls	0-4	Channery sandy loam.	SM, GM	A-2, A-4	0-10	65-85	60-75	50-70	25-50	20-25	NP-5
	4-12	Extremely channery sandy loam, very channery loam.	GM, GP-GM	A-1, A-2	5-20	20-50	15-50	5-40	5-30	20-25	NP-5
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
20	0-14	Loam	CL-ML	A-4	0-5	85-100	80-95	70-90	50-65	20-30	5-10
Clayburn	14-34	Clay loam, loam	CL-ML, CL	A-4, A-6	5-15	85-100	80-95	70-90	50-75	20-35	5-15
	34-60	Gravelly clay loam, gravelly loam, loam.	GM-GC, CL-ML, CL, SM-SC	A-4, A-6	0-15	65-100	60-100	45-70	35-55	20-35	5-15

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
21*:											
Cliffdown	0-5	Gravelly loam	SM	A-4	0-5	70-80	65-75	55-65	40-50	---	NP
	5-60	Stratified gravelly fine sandy loam to very gravelly loamy sand.	GP-GM, GM	A-1	0-5	30-60	20-55	20-40	5-25	---	NP
Cliffdown Variant	0-7	Very cobbly loam	GM-GC, SM-SC	A-2, A-4	25-35	50-75	40-65	35-55	25-40	20-30	5-10
	7-13	Very gravelly loam.	SM-SC, GM-GC	A-2, A-4	0-10	50-75	40-60	35-55	30-45	25-30	5-10
	13-24	Gravelly clay loam.	SC	A-2, A-6	0-5	60-80	55-75	35-65	30-50	30-40	10-20
	24	Weathered bedrock	---	---	---	---	---	---	---	---	---
22	0-4	Channery loam	GM-GC	A-4	5-20	50-75	50-75	45-65	35-50	25-30	5-10
Clifterson	4-60	Very gravelly loam, very gravelly clay loam.	GM-GC	A-2	5-10	20-55	20-55	20-40	10-25	25-30	5-10
23	0-19	Loam	ML	A-4	0-5	85-100	80-95	70-90	50-80	20-30	NP-5
Cochetopa	19-44	Clay, stony clay loam, clay loam.	CL, CH	A-7	5-30	70-90	60-90	55-85	50-80	40-60	20-40
	44-60	Clay loam, stony clay, stony clay loam.	CL	A-6, A-7	10-40	75-95	70-90	65-80	50-70	30-50	10-30
24*:											
Cochetopa	0-19	Loam	ML	A-4	0-5	85-100	80-95	70-90	50-80	20-30	NP-5
	19-44	Clay, stony clay loam, clay loam.	CL, CH	A-7	5-30	70-90	60-90	55-85	50-80	40-60	20-40
	44-60	Clay loam, stony clay, stony clay loam.	CL	A-6, A-7	10-40	75-95	70-90	65-80	50-70	30-50	10-30
Jerry	0-13	Loam	ML, CL-ML	A-4	0	80-100	75-100	70-95	50-70	20-30	NP-10
	13-60	Gravelly loam, cobbly clay loam, channery clay loam.	GC, CL, CL-ML, GM-GC	A-2, A-4, A-6, A-7	5-30	60-90	60-75	40-70	30-60	20-45	5-25
25	0-5	Sandy loam	SM	A-4, A-2	0	90-100	85-100	60-80	30-45	15-20	NP-5
Colorow	5-32	Stratified loam to fine sandy loam.	SM, ML	A-4	0	90-100	85-100	60-85	35-55	15-20	NP-5
	32-43	Stratified fine sandy loam to loamy fine sand.	SM	A-2, A-4	0	80-100	80-100	65-85	20-40	---	NP
	43-60	Stratified sandy loam to sand.	SM	A-2, A-4	0	80-100	75-100	50-80	15-40	---	NP
26*:											
Cowdrey	0-16	Loam	CL-ML	A-4	0-5	75-100	75-100	60-90	50-65	20-30	5-10
	16-60	Clay, gravelly clay, cobbly clay.	CH, GC	A-7	0-10	60-75	50-75	45-75	40-75	50-70	30-45
Tampico	0-15	Loam	CL-ML	A-4	0	100	100	85-95	60-75	25-30	5-10
	15-42	Gravelly loam, loam, clay loam.	CL-ML, SM-SC	A-4	0	80-95	70-85	65-80	45-55	25-30	5-10
	42-60	Cobbly clay loam	CL	A-6	15-30	85-100	75-90	70-85	50-65	30-35	10-15

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
27---------- Curecanti	0-9	Very cobbly loam	SM-SC, CL-ML	A-4	50-60	75-95	60-85	55-75	45-55	20-30	5-10
	9-16	Very cobbly sandy clay loam, very gravelly clay loam.	SM-SC, SC, GM-GC, GC	A-2, A-4, A-6	30-70	40-75	35-70	30-60	15-45	15-30	5-15
	16-60	Very cobbly sandy loam, very cobbly loamy sand.	SM, GM, GP-GM, SP-SM	A-2, A-1	30-70	25-60	25-60	15-50	5-30	15-25	NP-5
28*:											
Delson----------	0-12	Stony loam-------	CL-ML	A-4	10-20	85-95	85-95	70-90	50-70	20-30	5-10
	12-40	Stony clay loam, stony clay.	CL	A-6, A-7	10-25	85-95	85-95	80-90	60-85	35-50	15-30
	40-60	Stony clay loam, very stony clay loam.	CL	A-6, A-7	10-50	80-95	80-95	75-90	55-80	25-45	15-25
Perma----------	0-8	Cobbly loam------	GM, SM, ML, GM-GC	A-4	15-40	50-85	40-75	40-65	35-60	20-30	NP-10
	8-30	Extremely gravelly sandy loam, very cobbly loam, very cobbly sandy loam.	GM-GC, GM, SM-SC, SM	A-2, A-4, A-1	15-40	30-70	20-60	15-50	10-40	20-30	NP-10
	30-60	Extremely gravelly sandy loam, very cobbly sandy loam, very gravelly loam.	GM, GM-GC, SM, SM-SC	A-1, A-2	15-40	30-70	20-60	15-45	10-35	15-30	NP-10
29, 30---------- Dollard	0-3	Silty clay loam	CL, CH	A-7, A-6	0	95-100	95-100	90-100	80-95	35-60	15-40
	3-26	Silty clay, silty clay loam, clay.	CH, CL	A-7	0	95-100	95-100	90-100	80-90	40-60	20-40
	26	Weathered bedrock	---	---	---	---	---	---	---	---	---
31---------- Dollard	0-2	Silty clay loam	CL, CH	A-7, A-6	0	95-100	95-100	90-100	80-95	35-60	15-40
	2-24	Silty clay, silty clay loam, clay.	CH, CL	A-7	0	95-100	95-100	90-100	80-90	40-60	20-40
	24	Weathered bedrock	---	---	---	---	---	---	---	---	---
32*. Fluvaquents											
33, 34---------- Forelle	0-4	Loam----------	CL-ML, ML	A-4	0-10	85-100	85-100	75-100	55-75	25-35	5-10
	4-21	Clay loam, loam.	CL	A-6	0-10	85-100	85-100	80-100	50-80	25-35	10-15
	21-60	Loam----------	CL-ML, ML	A-4	0-10	85-100	85-100	75-100	55-75	25-35	5-10
35*:											
Gaynor----------	0-2	Silty clay loam	CL	A-7, A-6	0	95-100	95-100	95-100	70-90	30-50	15-35
	2-29	Silty clay loam, silty clay, clay.	CL, CH	A-7	0	95-100	95-100	95-100	75-95	40-60	20-40
	29	Weathered bedrock	---	---	---	---	---	---	---	---	---
Midway----------	0-4	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	4-13	Clay, clay loam, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	70-95	35-60	20-35
	13	Weathered bedrock	---	---	---	---	---	---	---	---	---
36---------- Glendive	0-6	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	65-85	30-55	20-35	NP-10
	6-60	Stratified loamy fine sand to silt loam.	SM, SM-SC	A-4, A-2	0	95-100	75-95	60-90	25-50	15-25	NP-10

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
37----------	0-13	Sandy loam-------	SM	A-2, A-4	0	95-100	90-100	60-70	30-40	15-25	NP-5
Glenton	13-60	Stratified loamy sand to sandy clay loam.	SM	A-2, A-4	0	85-100	75-100	60-70	30-50	20-25	NP-5
38, 39----------	0-11	Loam----------	CL-ML	A-4	0	100	95-100	90-95	50-80	20-30	5-10
Guben	11-15	Very gravelly sandy clay loam, very gravelly clay loam, gravelly loam.	GM-GC, GC	A-2, A-4, A-6	10-15	35-55	30-50	25-45	15-40	25-40	5-20
	15-23	Very gravelly sandy clay loam, very gravelly loam, extremely gravelly sandy loam.	GM-GC, GC	A-2	15-30	30-40	25-35	15-30	10-25	25-35	5-15
	23-60	Very cobbly sandy loam.	GM-GC, GC	A-2	25-45	45-65	40-60	30-50	10-35	25-30	5-10
40----------	0-5	Loam----------	CL-ML	A-4	0	100	100	85-95	60-75	20-30	5-10
Hagga	5-60	Stratified silty clay loam to loamy fine sand.	CL	A-6	0	100	100	80-100	55-80	30-40	10-20
41----------	0-21	Loam----------	CL-ML	A-4	0	100	100	80-95	60-90	20-30	5-10
Havre	21-60	Stratified fine sandy loam to clay loam.	CL-ML, CL	A-4, A-6	0	100	100	70-95	60-80	20-35	5-15
42----------	0-5	Channery loam----	GM-GC	A-4	0-10	55-80	50-75	45-60	35-55	20-30	5-10
Irigul	5-12	Very channery loam, very channery clay loam, extremely channery loam.	GM-GC	A-2	10-15	50-75	15-50	10-35	10-30	20-30	5-10
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
43*:											
Irigul----------	0-5	Channery loam----	GM-GC	A-4	0-10	55-80	50-75	45-60	35-55	20-30	5-10
	5-12	Very channery loam, very channery clay loam, extremely channery loam.	GM-GC	A-2	10-15	50-75	15-50	10-35	10-30	20-30	5-10
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Parachute-------	0-4	Loam----------	CL-ML	A-4	0	90-100	90-100	65-95	50-75	20-30	5-10
	4-24	Loam, channery loam.	CL-ML, SM-SC, GM-GC	A-4	0	65-100	55-95	50-95	35-75	20-30	5-10
	24-38	Very channery loam, very channery sandy loam, extremely channery sandy loam.	GM-GC, GM	A-1, A-2	5-30	25-40	20-35	15-30	10-20	<25	NP-10
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
44----------	0-13	Loam----------	ML, CL-ML	A-4	0	80-100	75-100	70-95	50-70	20-30	NP-10
Jerry	13-60	Gravelly loam, cobbly clay loam, channery clay loam.	GC, CL, CL-ML, GM-GC	A-2, A-4, A-6, A-7	5-30	60-90	60-75	40-70	30-60	20-45	5-25

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
45*:											
Jerry	0-13	Loam	ML, CL-ML	A-4	0	80-100	75-100	70-95	50-70	20-30	NP-10
	13-60	Gravelly loam, cobbly clay loam, channery clay loam.	GC, CL, CL-ML, GM-GC	A-2, A-4, A-6, A-7	5-30	60-90	60-75	40-70	30-60	20-45	5-25
Thornburgh	0-14	Channery loam	GM-GC, CL-ML, SM-SC	A-4	5-10	65-90	60-75	50-70	35-60	20-30	5-10
	14-27	Very channery loam, very cobbly loam.	GM-GC	A-4, A-2	10-25	40-60	40-60	35-55	25-50	20-30	5-10
	27-60	Very channery sandy loam, very channery loam, very cobbly loam.	GM	A-2, A-1	10-35	40-60	35-60	25-60	15-35	10-20	NP-5
Rhone	0-24	Loam	CL, CL-ML	A-4, A-6	0	90-100	80-95	70-90	50-70	20-35	5-15
	24-50	Channery sandy clay loam, very channery sandy clay loam, very channery loam.	GM-GC	A-2	0-10	45-60	40-55	30-50	15-35	20-30	5-10
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
46	0-5	Fine sandy loam	SM, ML	A-4	0-5	80-100	75-100	60-90	35-70	20-25	NP-5
Kinnear	5-60	Sandy clay loam, loam.	SM, ML	A-4	0-5	80-100	80-100	70-80	40-60	30-40	5-10
47, 48	0-12	Silty clay loam	CL	A-7, A-6	0	95-100	90-100	85-100	80-95	30-45	10-20
Kobar	12-60	Silty clay loam, silty clay, clay.	CL	A-7, A-6	0	95-100	90-100	85-100	75-95	35-50	15-25
49	0-7	Silty clay loam	CL	A-7, A-6	0	95-100	90-100	85-100	80-95	30-45	10-20
Kobar	7-60	Silty clay loam, silty clay, clay.	CL	A-7, A-6	0	95-100	90-100	85-100	75-95	35-50	15-25
50*:											
Lamphier	0-26	Loam	ML	A-4	0-10	80-100	75-100	70-95	50-75	25-35	NP-5
	26-60	Loam, clay loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0-10	80-100	75-100	70-100	55-80	25-40	5-15
Tampico	0-15	Loam	CL-ML	A-4	0	100	100	85-95	60-75	25-30	5-10
	15-42	Gravelly loam, loam, clay loam.	CL-ML, SM-SC	A-4	0	80-95	70-85	65-80	45-55	25-30	5-10
	42-60	Cobbly clay loam	CL	A-6	15-30	85-100	75-90	70-85	50-65	30-35	10-15
Kamack	0-14	Loam	CL-ML	A-4	0-5	75-85	75-85	70-80	50-60	20-30	5-10
	14-55	Very gravelly loam, very cobbly clay loam, very cobbly loam.	GM-GC	A-2	0-35	25-50	20-45	15-40	10-30	20-30	5-10
	55	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
51*:											
Mergel	0-12	Channery loam	SM, ML	A-4	0-10	70-80	50-75	50-65	35-55	20-35	NP-10
	12-60	Very gravelly loam, very channery loam, very channery clay loam.	GM-GC, GC	A-2	0-20	25-50	20-50	15-40	10-35	20-40	5-15

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
51*											
Redthayne	0-8	Channery loam	ML, GM, SM	A-4, A-2	0-5	60-85	50-75	50-70	30-55	20-25	NP-5
	8-18	Very channery loam, very channery clay loam.	GC, GM-GC	A-2	5-15	40-60	35-55	25-50	20-35	25-35	5-15
	18-60	Very channery loam.	GM-GC	A-2, A-4	5-15	40-65	40-60	35-55	25-40	20-30	5-10
Dollard	0-3	Silty clay loam	CL, CH	A-7, A-6	0	95-100	95-100	90-100	80-95	35-60	15-40
	3-26	Silty clay, silty clay loam, clay.	CH, CL	A-7	0	95-100	95-100	90-100	80-90	40-60	20-40
	26	Weathered bedrock	---	---	---	---	---	---	---	---	---
52	0-8	Fine sandy loam	SM, ML	A-4	0	80-100	75-100	70-85	35-55	---	NP
Miracle	8-27	Sandy clay loam, loam.	SC, CL	A-6	0	80-100	75-100	70-90	40-55	25-35	10-15
	27-32	Weathered bedrock	---	---	---	---	---	---	---	---	---
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
53	0-2	Stony clay loam	CL	A-6	10-25	90-100	85-100	70-90	60-80	35-40	15-20
Moyerson	2-17	Silty clay, clay, clay loam.	CL, CH	A-7	0-15	95-100	95-100	85-95	80-90	45-65	20-35
	17	Weathered bedrock	---	---	---	---	---	---	---	---	---
54*:											
Nagitsy	0-23	Channery loam	GM, SM	A-2, A-4	0-5	50-75	50-75	45-65	30-50	20-30	NP-5
	23-33	Very gravelly loam, very channery loam.	GM	A-2, A-1	5-25	35-55	30-50	25-45	20-35	20-30	NP-5
	33	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Irigul	0-5	Channery loam	GM-GC	A-4	0-10	55-80	50-75	45-60	35-55	20-30	5-10
	5-12	Very channery loam, very channery clay loam, extremely channery loam.	GM-GC	A-2	10-15	50-75	15-50	10-35	10-30	20-30	5-10
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
55	0-5	Channery sandy loam.	GM, SM	A-1, A-2	0-5	60-85	50-75	35-55	20-35	20-25	NP-5
Nihill	5-60	Very channery loam, very channery sandy loam.	GM, GM-GC	A-1, A-2	10-20	30-60	20-50	15-40	10-35	20-30	NP-10
56	0-25	Loam	CL-ML, SM-SC	A-4	0	75-95	75-90	60-85	45-65	20-30	5-10
Northwater	25-47	Very channery clay loam, very channery loam, very channery sandy clay loam.	GC, GM-GC	A-6, A-2, A-4	25-30	40-60	40-50	35-45	30-40	20-35	5-15
	47	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
57*:											
Owen Creek	0-5	Loam	CL-ML	A-4	0	85-100	85-100	70-85	50-60	25-30	5-15
	5-24	Clay loam, clay	CL	A-7	0	85-100	75-100	70-95	60-80	40-50	20-30
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
57*:											
Jerry	0-13	Loam	ML, CL-ML	A-4	0	80-100	75-100	70-95	50-70	20-30	NP-10
	13-60	Gravelly loam, cobbly clay loam, channery clay loam.	GC, CL, CL-ML, GM-GC	A-2, A-4, A-6, A-7	5-30	60-90	60-75	40-70	30-60	20-45	5-25
Burnette	0-5	Loam	CL-ML	A-4	0-5	85-100	80-100	65-90	55-75	20-30	5-10
	5-10	Clay loam, silty clay loam.	CL	A-6, A-7	0-5	85-100	80-100	70-95	60-90	30-45	10-20
	10-30	Clay, clay loam, silty clay.	CL, CH	A-7	0-10	90-100	85-100	70-95	65-90	40-55	15-30
	30-60	Clay, clay loam, silty clay.	CL	A-6, A-7	0-10	90-100	85-100	70-95	65-90	35-50	15-25
58	0-4	Loam	CL-ML	A-4	0	90-100	90-100	65-95	50-75	20-30	5-10
Parachute	4-24	Loam, channery loam.	CL-ML, SM-SC, GM-GC	A-4	0	65-100	55-95	50-95	35-75	20-30	5-10
	24-38	Very channery loam, very channery sandy loam, extremely channery sandy loam.	GM-GC, GM	A-1, A-2	5-30	25-40	20-35	15-30	10-20	<25	NP-10
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
59*:											
Parachute	0-4	Loam	CL-ML	A-4	0	90-100	90-100	65-95	50-75	20-30	5-10
	4-32	Loam, channery loam.	CL-ML, SM-SC, GM-GC	A-4	0	65-100	55-95	50-95	35-75	20-30	5-10
	32-38	Very channery loam, very channery sandy loam, extremely channery sandy loam.	GM-GC, GM	A-1, A-2	5-30	25-40	20-35	15-30	10-20	<25	NP-10
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rhone	0-24	Loam	CL, CL-ML	A-4, A-6	0	90-100	80-95	70-90	50-70	20-35	5-15
	24-50	Channery sandy clay loam, very channery sandy clay loam, very channery loam.	GM-GC	A-2	0-10	45-60	40-55	30-50	15-35	20-30	5-10
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
60, 61, 62	0-10	Loam	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	85-100	65-95	20-35	5-15
Patent	10-60	Loam, clay loam, very fine sandy loam.	CL, CL-ML	A-6, A-7, A-4	0-5	85-100	75-100	70-100	65-95	20-45	5-25
63	0-5	Loam	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	85-100	65-95	20-35	5-15
Patent	5-60	Loam, clay loam, very fine sandy loam.	CL, CL-ML	A-6, A-7, A-4	0-5	85-100	75-100	70-100	65-95	20-45	5-25
64	0-4	Fine sandy loam	ML, SM	A-4	0	85-100	80-100	75-90	40-65	---	NP
Piceance	4-22	Loam, sandy clay loam, clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	80-95	75-90	60-80	40-70	20-35	5-15
	22-30	Channery sandy loam, channery loam, channery sandy clay loam.	GM, GM-GC, SM, SM-SC	A-2, A-1, A-4	0-5	55-80	50-65	40-60	15-45	15-30	NP-10
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
65----------	0-3	Clay loam--------	CL	A-6	0	95-100	90-100	70-100	60-80	30-40	10-20
Pinelli	3-31	Clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	90-100	70-100	60-85	35-45	15-25
	31-60	Clay loam, loam, silty clay loam.	CL	A-6	0	95-100	90-100	65-90	55-80	25-35	10-15
66*:											
Potts----------	0-3	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	60-70	30-40	---	NP
	3-17	Clay loam, loam	CL	A-6	0	95-100	90-100	70-100	55-80	25-35	10-15
	17-60	Loam, clay loam.	ML	A-4	0	95-100	90-100	65-90	50-70	25-35	NP-5
Begay----------	0-9	Fine sandy loam	SM	A-4	0	100	100	70-85	40-50	20-25	NP-5
	9-30	Very fine sandy loam, fine sandy loam.	ML, CL-ML	A-4	0	95-100	90-100	80-95	50-65	20-30	NP-10
	30-60	Very fine sandy loam, loamy fine sand, fine sandy loam.	ML, SM	A-4	0	100	100	75-95	35-65	20-30	NP-5
67----------	0-12	Flaggy loam------	ML	A-4	5-15	80-95	75-90	60-75	50-70	20-30	NP-5
Rabbitex	12-21	Channery loam, loam.	ML, SM, GM	A-4, A-2	0-5	65-90	55-80	35-75	30-70	20-30	NP-5
	21-43	Channery loam----	ML, SM, GM	A-4, A-2	0-10	50-90	55-80	35-70	25-65	20-30	NP-5
	43	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
68*:											
Rabbitex--------	0-12	Loam------------	ML	A-4	0-5	85-95	75-95	60-75	50-70	20-30	NP-5
	12-21	Channery loam, loam.	ML, SM, GM	A-4, A-2	0-5	65-90	55-80	35-75	30-70	20-30	NP-5
	21-43	Channery loam, very channery loam.	ML, SM, GM	A-4, A-2	0-10	50-90	55-80	35-70	25-65	20-30	NP-5
	43	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Work----------	0-10	Loam------------	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	65-85	55-75	25-35	5-15
	10-30	Clay, clay loam	CL, CH	A-7, A-6	0-5	90-100	80-100	70-95	60-85	30-55	10-30
	30-60	Clay loam, loam	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	80-100	65-90	55-80	25-45	5-20
69----------	0-35	Channery sandy loam.	SM, GM	A-2, A-1	0-5	65-75	50-75	30-65	15-35	20-25	NP-5
Razorba	35-60	Channery sandy loam, very channery sandy loam.	SM, GM	A-1, A-2	0-5	30-75	30-75	20-65	10-35	20-25	NP-5
70*:											
Redcreek--------	0-11	Sandy loam-------	SM-SC	A-4	0-5	85-100	85-100	70-85	35-50	15-25	5-10
	11-16	Channery sandy loam.	GM, SM	A-2, A-4	0-10	60-80	50-75	35-60	20-40	---	NP-5
	16	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rentsac---------	0-5	Channery loam----	SM, ML, GM	A-4	0-15	70-85	60-75	45-65	35-55	15-25	NP-5
	5-16	Very channery loam, very channery sandy loam, very flaggy loam.	SM, GM	A-2, A-4, A-1	15-50	40-75	30-65	15-45	10-40	15-25	NP-5
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
71----------	0-17	Loam----------	CL-ML	A-4	0	95-100	95-100	85-95	60-75	20-25	5-10
Redrob	17-35	Stratified loam to loamy sand.	ML, SM	A-4	0-5	95-100	90-95	65-85	35-60	20-25	NP-5
	35-60	Very gravelly sand, very cobbly sand, very cobbly loamy sand.	GM, SM, GP-GM, SP-SM	A-1	30-50	40-65	30-50	20-35	5-15	---	NP
72----------	0-15	Loam----------	CL-ML	A-4	0	95-100	95-100	80-95	55-70	20-25	5-10
Redrob Variant	15-60	Stratified very gravelly loamy sand to cobbly sand.	GP, SP, SP-SM, GP-GM	A-1	15-30	45-65	35-55	15-25	0-10	---	NP
73----------	0-5	Channery loam----	SM, ML, GM	A-4	0-15	70-85	60-75	45-65	35-55	15-25	NP-5
Rentsac	5-16	Very channery loam, very channery sandy loam, very flaggy loam.	SM, GM	A-2, A-4, A-1	15-50	40-75	30-65	15-45	10-40	15-25	NP-5
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
74*:											
Rentsac---------	0-5	Channery loam----	SM, ML, GM	A-4	0-15	70-85	60-75	45-65	35-55	15-25	NP-5
	5-16	Very channery loam, very channery sandy loam, very flaggy loam.	SM, GM	A-2, A-4, A-1	15-50	40-75	30-65	15-45	10-40	15-25	NP-5
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Moyerson--------	0-2	Stony clay loam--	CL	A-6, A-7	10-25	80-95	75-90	60-80	50-75	35-45	15-25
	2-17	Clay loam, clay	CL, CH	A-7	0-10	80-95	75-90	70-85	60-80	40-55	20-30
	17	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
75*:											
Rentsac---------	0-5	Channery loam----	SM, ML, GM	A-4	0-15	70-85	60-75	45-65	35-55	15-25	NP-5
	5-16	Very channery loam, very channery sandy loam, very flaggy loam.	SM, GM	A-2, A-4, A-1	15-50	40-75	30-65	15-45	10-40	15-25	NP-5
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Piceance--------	0-4	Fine sandy loam	ML, SM	A-4	0	85-100	80-100	75-90	40-65	---	NP
	4-22	Loam, sandy clay loam, clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	80-95	75-90	60-80	40-70	20-35	5-15
	22-30	Channery sandy loam, channery loam, channery sandy clay loam.	GM, GM-GC, SM, SM-SC	A-2, A-1, A-4	0-5	55-80	50-75	40-60	15-45	15-30	NP-10
	30	Weathered bedrock	---	---	---	---	---	---	---	---	---
76----------	0-24	Loam----------	CL, CL-ML	A-4, A-6	0	90-100	80-95	70-90	50-70	20-35	5-15
Rhone	24-50	Channery sandy clay loam, very channery sandy clay loam, very channery loam.	GM-GC	A-2	0-10	45-60	40-55	30-50	15-35	20-30	5-10
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
77*:											
Rhone	0-24	Loam	CL, CL-ML	A-4, A-6	0	90-100	80-95	70-90	50-70	20-35	5-15
	24-50	Channery sandy clay loam, very channery sandy clay loam, very channery loam.	GM-GC	A-2	0-10	45-60	40-55	30-50	15-35	20-30	5-10
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Northwater	0-26	Loam	CL-ML, SM-SC	A-4	0	75-95	75-90	60-85	45-65	20-30	5-10
	26-48	Very channery clay loam, very channery loam, very channery sandy clay loam.	GC, GM-GC	A-6, A-2, A-4	25-30	40-60	40-50	35-45	30-40	20-35	5-15
	48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Lamphier	0-18	Loam	ML	A-4	0-10	80-100	75-100	70-95	50-75	25-35	NP-5
	18-60	Loam, clay loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0-10	80-100	75-100	70-100	55-80	25-40	5-15
78*. Rock outcrop											
79, 80, Shawa	0-16	Loam	CL-ML, SM-SC	A-4	0	90-100	85-100	70-95	40-75	25-30	5-10
	16-60	Loam, clay loam	CL	A-4, A-6	0	100	90-100	70-95	50-75	25-40	5-15
81, Shawa	0-8	Loam	ML	A-4	0	100	90-100	75-95	55-75	25-35	NP-5
	8-28	Clay loam, silty clay loam.	ML, CL	A-6, A-4	0	95-100	90-100	75-95	55-85	30-40	5-15
	28-60	Loam, clay loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	95-100	90-100	75-95	55-80	25-40	5-20
82, 83, Silas	0-24	Loam	ML	A-4	0-10	90-100	90-100	80-95	60-85	15-25	NP-5
	24-60	Stratified loam to sandy clay loam.	ML	A-4	0-10	90-100	90-100	80-95	60-85	15-25	NP-5
84, Silas Variant	0-20	Loam	ML, CL-ML	A-4	0	100	100	85-100	65-85	20-30	NP-10
	20-60	Loam, clay loam, silty clay loam.	CL-ML, CL	A-6	0	100	100	85-100	70-90	25-40	5-20
85, 86, Sinkson	0-3	Gravelly sandy loam.	GM	A-2, A-4	0-10	60-80	50-75	35-70	25-50	20-25	NP-5
	3-60	Gravelly loam	CL-ML, GM-GC, ML, GM	A-2, A-4	0-10	60-80	50-75	30-70	25-60	15-25	NP-10
87*:											
Starman	0-2	Channery loam	GM	A-1, A-2	0-15	35-55	30-50	30-45	20-35	30-40	5-10
	2-17	Gravelly loam, channery loam, very channery loam.	GM	A-1, A-2	0-15	35-55	30-50	30-45	20-35	30-40	5-10
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Vandamore	0-4	Channery loam	CL-ML, GM-GC	A-4	0-5	55-75	50-75	40-65	35-55	20-30	5-10
	4-25	Very channery loam, extremely channery loam.	GM, GM-GC	A-2, A-1	0-20	25-60	20-55	20-50	15-35	20-30	NP-10
	25	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
88*:											
Tampico	0-15	Loam	CL-ML	A-4	0	100	100	85-95	60-75	25-30	5-10
	15-42	Gravelly loam, loam, clay loam.	CL-ML, SM-SC	A-4	0	80-95	70-85	65-80	45-55	25-30	5-10
	42-60	Cobbly clay loam	CL	A-6	15-30	85-100	75-90	70-85	50-65	30-35	10-15
Miracle	0-8	Fine sandy loam	SM, ML	A-4	0	80-100	75-100	70-85	35-55	---	NP
	8-27	Sandy clay loam, loam.	SC, CL	A-6	0	80-100	75-100	70-90	40-55	25-35	10-15
	27-32	Weathered bedrock	---	---	---	---	---	---	---	---	---
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
89 Tisworth	0-4	Fine sandy loam	SM-SC, SC	A-2	0	75-100	75-100	50-70	25-35	20-30	5-10
	4-11	Loam, sandy clay loam, clay loam.	SC, CL	A-6	0	75-100	75-100	65-95	35-75	25-35	10-15
	11-60	Stratified loam to sandy loam.	SM, SM-SC	A-1, A-2, A-4	0	80-100	75-100	40-80	20-50	15-25	NP-10
90*. Torrifluvents.											
91*: Torriorthents.											
Rock outcrop.											
92 Trembles	0-8	Loam	SM, ML	A-4	0	100	100	75-85	45-55	20-30	NP-5
	8-60	Sandy loam, fine sandy loam.	SM, ML	A-2, A-4	0	100	100	65-85	30-55	20-30	NP-5
93, 94 Turley	0-4	Fine sandy loam	SM	A-4	0	100	100	70-80	40-50	20-25	NP-5
	4-60	Clay loam, silty clay loam, loam.	CL	A-6	0	100	100	85-100	65-80	30-40	10-20
95 Uffens	0-2	Loam	CL, CL-ML	A-6, A-4	0	100	100	85-95	55-75	25-35	5-15
	2-19	Clay loam, silty clay loam.	CL	A-6	0	100	100	85-95	65-85	30-40	10-20
	19-60	Sandy clay loam, loam, clay loam.	CL	A-6	0	100	100	85-95	55-75	30-40	10-15
96 Veatch	0-8	Channery loam	SM, ML, GM	A-4	0-5	70-90	60-75	50-70	35-65	20-30	NP-5
	8-18	Channery loam, channery sandy loam.	SM, GM	A-4, A-2, A-1	0-5	60-85	50-75	30-65	20-50	20-30	NP-5
	18-32	Very channery sandy loam, extremely channery loam.	GM, SM	A-1	15-20	35-60	25-50	20-30	10-25	20-30	NP-5
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
97 Walknolls	0-4	Channery sandy loam.	SM, GM	A-2, A-4	0-10	65-85	60-75	50-70	25-50	20-25	NP-5
	4-12	Extremely channery sandy loam, very channery loam.	GM, GP-GM	A-1, A-2	15-20	20-50	15-50	5-40	5-30	20-25	NP-5
	12	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
98*: Waybe	0-4	Flaggy clay loam	CL	A-6	25-40	85-100	85-100	85-100	70-80	30-40	10-20
	4-19	Silty clay loam, channery silty clay loam, clay.	CL	A-6, A-7	0-10	75-100	70-100	65-100	60-95	30-45	10-25
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 9.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
98*:											
Vandamore Variant--------	0-5	Channery loam----	CL-ML, GM-GC	A-4	0-5	55-75	50-70	40-65	35-55	20-30	5-10
	5-33	Very channery loam, very channery clay loam.	GM, GM-GC	A-1, A-2	0-20	30-60	25-55	20-50	15-35	15-30	NP-10
	33	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
99*:											
Winnemucca------	0-16	Loam----------	CL-ML	A-4	0	90-100	85-95	75-85	55-70	20-30	5-10
	16-60	Cobbly clay, very cobbly clay loam.	CL	A-6, A-7	45-70	90-100	85-95	80-90	75-80	30-50	10-25
Clayburn--------	0-14	Loam----------	CL-ML	A-4	0-5	85-100	80-95	70-90	50-65	20-30	5-10
	14-60	Clay loam, loam	CL-ML, CL	A-4, A-6	5-15	85-100	80-95	70-90	50-75	20-35	5-15
100, 101, 102----	0-10	Loam----------	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	65-85	55-75	25-35	5-15
Work	10-30	Clay, clay loam	CL, CH	A-7, A-6	0-5	90-100	80-100	70-95	60-85	30-55	10-30
	30-60	Gravelly clay loam, gravelly loam, clay loam.	CL, CL-ML, GC, SC	A-4, A-6, A-7	0-10	60-90	55-85	45-75	40-65	25-45	5-20
103----------	0-4	Loam----------	CL, CL-ML	A-6, A-4	0-5	90-100	80-100	65-85	55-75	25-35	5-15
Work	4-25	Clay, clay loam	CL, CH	A-7, A-6	0-5	90-100	80-100	70-95	60-85	30-55	10-30
	25-60	Clay loam, loam, gravelly loam.	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	60-100	65-90	55-80	25-45	5-20
104----------	0-4	Loam----------	CL-ML	A-4	0	80-100	75-100	60-85	55-75	25-30	5-10
Yamac	4-22	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	80-100	75-100	65-90	60-80	25-35	5-15
	22-60	Loam, clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	80-100	75-100	60-85	55-75	25-35	5-15
105, 106, 107----	0-13	Clay loam--------	CL	A-6	0-5	80-95	75-90	65-75	50-65	25-35	10-15
Zoltay	13-31	Gravelly clay, cobbly clay, cobbly clay loam.	CL, GC, SC	A-6, A-7	5-30	65-85	60-80	50-75	45-70	30-50	15-30
	31-60	Cobbly clay loam, stony clay loam, cobbly loam.	CB-CL, ST-CL, CB-L	A-6	25-30	55-80	50-75	45-70	40-60	25-40	10-20
108----------	0-9	Clay loam--------	CL	A-6	0-5	80-95	75-90	65-75	50-65	25-35	10-15
Zoltay	9-27	Gravelly clay, cobbly clay, cobbly clay loam.	CL, GC, SC	A-6, A-7	5-30	65-85	60-80	50-75	45-70	30-50	15-30
	27-60	Cobbly clay loam, stony clay loam, cobbly loam.	CB-CL, ST-CL, CB-L	A-6	25-30	55-80	50-75	45-70	40-60	25-40	10-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
1----------	0-4	35-40	0.2-0.6	0.16-0.20	7.4-8.4	<4	Moderate	0.43	2	4	0.5-1
Abor	4-33	40-55	<0.2	0.12-0.16	7.9-9.0	<4	High------	0.37			
	33	---	---	---	---	---	----------	----			
2*:											
Absarokee-------	0-4	20-27	0.6-2.0	0.09-0.13	6.1-7.3	<2	Low-------	0.32	2	6	1-2
	4-22	30-45	0.2-0.6	0.12-0.16	6.1-7.3	<2	High------	0.32			
	22-26	35-45	0.2-0.6	0.10-0.14	7.4-8.4	<2	High------	0.32			
	26	---	---	---	---	---	----------	----			
Delson----------	0-7	15-27	0.6-2.0	0.12-0.15	6.6-7.3	<2	Low-------	0.17	5	8	2-4
	7-60	35-50	0.06-0.2	0.14-0.21	6.6-7.3	<2	High------	0.20			
3, 4----------	0-3	15-27	0.2-0.6	0.12-0.16	6.6-8.4	4-8	Low-------	0.49	5	5	.5-1
Absher	3-13	40-45	<0.06	0.08-0.12	6.6-8.4	8-16	High------	0.37			
	13-60	35-50	<0.06	0.04-0.10	>7.8	>8	High------	0.43			
5*.											
Badland											
6----------	0-6	5-10	6.0-20.0	0.06-0.10	7.9-8.4	<2	Low-------	0.10	5	8	.5-1
Barcus	6-16	2-6	6.0-20.0	0.04-0.06	7.9-8.4	<2	Low-------	0.10			
	16-60	5-10	6.0-20.0	0.05-0.07	7.9-9.0	<2	Low-------	0.10			
7----------	0-6	27-35	0.06-0.2	0.15-0.18	7.4-9.0	2-8	Moderate	0.43	5	4L	<.5
Billings	6-60	27-35	0.06-0.2	0.15-0.18	7.4-9.0	2-8	Moderate	0.43			
8*:											
Billings--------	0-2	27-35	0.06-0.2	0.15-0.18	7.4-9.0	2-8	Moderate	0.43	5	4L	<.5
	2-60	27-35	0.06-0.2	0.15-0.18	7.4-9.0	2-8	Moderate	0.43			
Torrifluvents.											
9*:											
Blakabin--------	0-3	30-35	0.06-0.2	0.18-0.20	7.4-8.4	<2	Moderate	0.28	5	4	2-4
	3-32	35-50	0.06-0.2	0.17-0.20	7.9-8.4	<2	High------	0.32			
	32-50	35-50	0.06-0.2	0.16-0.18	7.9-8.4	<2	High------	0.32			
	50-60	30-40	0.06-0.2	0.12-0.16	7.9-9.0	<2	High------	0.32			
Rhone-----------	0-24	20-27	0.6-2.0	0.19-0.21	6.6-7.8	<2	Low-------	0.24	3	6	3-6
	24-50	20-30	0.6-2.0	0.08-0.10	6.6-7.8	<2	Low-------	0.20			
	50	---	---	---	---	---	----------	----			
Waybe-----------	0-4	27-40	0.2-0.6	0.12-0.16	7.4-8.4	<4	Moderate	0.32	1	4L	<.5
	4-19	35-45	0.06-0.2	0.14-0.18	7.9-8.4	<4	Moderate	0.37			
	19	---	---	---	---	---	----------	----			
10*:											
Blazon----------	0-4	18-35	0.2-0.6	0.14-0.16	7.9-9.0	2-4	Moderate	0.32	1	4L	.5-1
	4-16	27-35	0.2-0.6	0.14-0.16	7.9-9.0	2-4	Moderate	0.32			
	16	---	---	---	---	---	----------	----			
Rentsac---------	0-5	7-18	2.0-6.0	0.08-0.12	6.6-8.4	<2	Low-------	0.28	1	6	.5-2
	5-16	7-18	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low-------	0.28			
	16	---	---	---	---	---	----------	----			
11*:											
Borollic Calciorthids.											

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
11*:											
Guben	0-11	10-15	0.6-2.0	0.15-0.17	6.6-7.8	<2	Low	0.32	2	3	2-4
	11-15	18-30	0.6-2.0	0.08-0.12	6.6-8.4	<2	Moderate	0.17			
	15-23	10-25	0.6-2.0	0.07-0.11	7.4-8.4	<2	Low	0.17			
	23-60	10-20	2.0-6.0	0.06-0.09	7.4-8.4	<2	Low	0.10			
12*:											
Bucklon	0-10	20-27	0.06-0.2	0.17-0.20	6.1-7.3	<2	Moderate	0.24	1	5	2-5
	10-17	20-35	0.06-0.2	0.16-0.18	6.1-7.3	<2	Moderate	0.24			
	17	---	---	---	---	---	---	---			
Inchau	0-11	15-27	0.6-2.0	0.16-0.18	6.1-7.8	---	Low	0.32	3	5	2-5
	11-35	20-35	0.6-2.0	0.11-0.15	6.1-7.8	---	Moderate	0.28			
	35	---	---	---	---	---	---	---			
13	0-5	30-40	0.06-0.2	0.12-0.14	7.4-8.4	<2	Moderate	0.15	5	4	1-2
Bulkley	5-20	35-55	0.06-0.2	0.15-0.17	7.9-8.4	<2	High	0.24			
	20-48	30-40	0.06-0.2	0.13-0.16	7.9-8.4	2-8	High	0.24			
	48	---	---	---	---	---	---	---			
14*:											
Bulkley	0-3	28-40	0.06-0.2	0.18-0.20	7.4-8.4	<2	High	0.24	5	4L	1-2
	3-58	35-55	0.06-0.2	0.15-0.17	7.9-8.4	<2	High	0.24			
	58	---	---	---	---	---	---	---			
Abor	0-4	35-40	0.2-0.6	0.16-0.20	7.4-8.4	<4	Moderate	0.43	2	4	.5-1
	4-33	40-55	<0.2	0.12-0.16	7.9-9.0	<4	High	0.37			
	33	---	---	---	---	---	---	---			
15	0-7	10-20	0.6-6.0	0.12-0.16	6.6-7.8	<2	Low	0.28	1	5	2-4
Castner	7-11	10-20	0.6-6.0	0.06-0.10	6.6-8.4	<2	Low	0.24			
	11-17	10-20	0.6-6.0	0.05-0.08	7.4-8.4	<2	Low	0.24			
	17	---	---	---	---	---	---	---			
16	0-3	28-47	0.06-0.2	0.11-0.15	7.4-8.4	4-16	Moderate	0.43	1	4L	<.5
Chipeta	3-18	35-45	0.06-0.2	0.11-0.15	7.4-8.4	4-16	High	0.43			
	18	---	---	---	---	---	---	---			
17	0-2	28-47	0.06-0.2	0.11-0.15	7.4-8.4	4-16	Moderate	0.43	1	4L	<.5
Chipeta	2-12	35-45	0.06-0.2	0.11-0.15	7.4-8.4	4-16	High	0.43			
	12	---	---	---	---	---	---	---			
18*:											
Chipeta	0-3	28-47	0.06-0.2	0.11-0.15	7.4-8.4	4-16	Moderate	0.43	1	4L	<.5
	3-18	35-45	0.06-0.2	0.11-0.15	7.4-8.4	4-16	High	0.43			
	18	---	---	---	---	---	---	---			
Killpack	0-4	27-35	0.2-0.6	0.15-0.19	7.4-8.4	2-8	Moderate	0.43	2	4L	<.7
	4-30	27-35	0.06-0.2	0.15-0.19	7.4-8.4	2-8	Moderate	0.43			
	30	---	---	---	---	---	---	---			
19*:											
Chipeta	0-5	28-47	0.06-0.2	0.11-0.15	7.4-8.4	8-16	Moderate	0.43	1	4L	<.5
	5-12	35-45	0.06-0.2	0.11-0.15	7.4-8.4	8-16	High	0.43			
	12	---	---	---	---	---	---	---			
Walknolls	0-4	12-20	2.0-6.0	0.09-0.12	7.9-9.0	<2	Low	0.20	1	8	.5-1
	4-12	18-27	2.0-6.0	0.05-0.09	7.9-9.0	<2	Low	0.24			
	12	---	---	---	---	---	---	---			
20	0-14	15-25	0.6-2.0	0.16-0.18	6.1-7.3	<2	Low	0.20	4	5	2-5
Clayburn	14-34	20-35	0.6-2.0	0.14-0.16	6.1-7.8	<2	Moderate	0.28			
	34-60	20-35	0.6-2.0	0.10-0.12	6.1-7.3	<2	Moderate	0.20			
21*:											
Cliffdown	0-5	10-15	2.0-6.0	0.11-0.13	7.4-9.0	<2	Low	0.32	2	6	.3-.5
	5-60	5-15	2.0-6.0	0.06-0.07	7.9-9.0	4-16	Low	0.20			

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
21*:											
Cliffdown Variant	0-7	15-25	0.6-2.0	0.08-0.11	7.9-8.4	<2	Low	0.10	1	8	<1
	7-13	15-27	0.6-2.0	0.09-0.12	7.9-9.0	<2	Moderate	0.10			
	13-24	27-35	0.2-0.6	0.09-0.12	7.9-9.0	<2	Moderate	0.20			
	24	---	---	---	---	---	---	---			
22 Clifterson	0-4	18-27	2.0-6.0	0.09-0.13	7.9-9.0	<2	Low	0.28	5	4L	.5-1
	4-60	18-30	2.0-6.0	0.04-0.09	7.9-9.0	<2	Low	0.24			
23 Cochetopa	0-19	20-27	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low	0.24	5	6	3-6
	19-44	35-50	0.06-0.2	0.11-0.14	6.6-7.8	<2	High	0.24			
	44-60	35-50	0.06-0.2	0.10-0.13	7.4-7.8	<2	High	0.24			
24*:											
Cochetopa	0-19	20-27	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low	0.24	5	6	3-6
	19-44	35-50	0.06-0.2	0.11-0.14	6.6-7.8	<2	High	0.24			
	44-60	35-50	0.06-0.2	0.10-0.13	7.4-7.8	<2	High	0.24			
Jerry	0-13	15-35	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low	0.24	5	6	3-5
	13-60	20-40	0.6-2.0	0.13-0.15	6.6-8.4	<2	Moderate	0.24			
25 Colorow	0-5	8-18	2.0-6.0	0.11-0.14	7.4-8.4	<2	Low	0.20	5	3	<1
	5-32	10-18	2.0-6.0	0.11-0.14	7.4-8.4	<2	Low	0.20			
	32-43	7-18	2.0-6.0	0.08-0.10	7.4-8.4	<2	Low	0.17			
	43-60	5-15	>6.0	0.05-0.08	7.4-8.4	<2	Low	0.15			
26*:											
Cowdrey	0-16	15-27	0.6-2.0	0.15-0.17	6.1-6.5	<2	Low	0.28	5	5	.5-1
	16-60	40-50	0.06-0.2	0.14-0.16	6.1-7.3	<2	High	0.10			
Tampico	0-15	18-25	0.6-2.0	0.16-0.18	5.6-7.3	<2	Low	0.37	5	6	---
	15-42	22-30	0.6-2.0	0.13-0.16	6.1-7.3	<2	Low	0.37			
	42-60	28-32	0.6-2.0	0.13-0.15	6.6-7.8	<2	Low	0.32			
27 Curecanti	0-9	15-25	0.6-2.0	0.06-0.10	5.6-7.3	<2	Low	0.17	5	8	2-4
	9-16	25-35	0.6-2.0	0.06-0.10	5.6-7.3	<2	Low	0.24			
	16-60	5-20	2.0-20	0.05-0.08	5.6-7.3	<2	Low	0.15			
28*:											
Delson	0-12	15-25	0.6-2.0	0.13-0.15	6.1-7.3	<2	Low	0.17	5	8	2-4
	12-40	35-45	0.06-0.2	0.13-0.15	6.6-7.3	<2	High	0.20			
	40-60	30-40	0.2-0.6	0.13-0.15	7.4-7.8	<2	Moderate	0.20			
Perma	0-8	15-27	0.6-2.0	0.10-0.14	6.1-7.8	<2	Low	0.32	5	5	2-4
	8-30	15-27	0.6-2.0	0.06-0.10	6.1-7.8	<2	Low	0.28			
	30-60	10-20	0.6-2.0	0.05-0.08	6.1-7.8	<2	Low	0.20			
29, 30 Dollard	0-3	35-45	0.06-0.2	0.17-0.19	7.4-9.0	<2	High	0.37	2	4L	1-2
	3-26	35-50	0.06-0.2	0.13-0.18	7.4-9.0	<2	High	0.37			
	26	---	---	---	---	---	---	---			
31 Dollard	0-2	35-45	0.06-0.2	0.17-0.19	7.4-9.0	<2	High	0.37	2	4L	1-2
	2-24	35-50	0.06-0.2	0.13-0.18	7.4-9.0	<2	High	0.37			
	24	---	---	---	---	---	---	---			
32*. Fluvaquents											
33, 34 Forelle	0-4	15-27	0.6-2.0	0.16-0.18	6.6-9.0	<2	Low	0.28	5	6	.5-1
	4-21	20-35	0.6-2.0	0.16-0.21	6.6-9.0	<2	Moderate	0.32			
	21-60	20-30	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low	0.28			
35*:											
Gaynor	0-2	30-50	0.2-0.6	0.14-0.17	7.4-8.4	<2	High	0.37	2	4L	.5-1
	2-29	35-55	0.06-0.2	0.12-0.16	7.9-9.0	2-8	High	0.37			
	29	---	---	---	---	---	---	---			

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
35*:											
Midway	0-4	30-40	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.43	1	4L	0.5-2
	4-13	35-45	0.06-0.2	0.14-0.18	7.4-9.0	2-8	High	0.43			
	13	---	---	---	---	---	---	---			
36	0-6	5-15	2.0-6.0	0.12-0.18	7.4-9.0	<4	Low	0.20	5	3	.5-2
Glendive	6-60	5-18	2.0-6.0	0.10-0.16	7.4-9.0	2-8	Low	0.20			
37	0-13	5-18	2.0-6.0	0.11-0.13	7.4-9.0	<2	Low	0.24	5	3	.4-1
Glenton	13-60	15-18	2.0-6.0	0.11-0.13	7.9-8.4	<2	Low	0.24			
38, 39	0-11	10-15	0.6-2.0	0.15-0.17	6.6-7.8	<2	Low	0.32	2	3	2-4
Guben	11-15	18-30	0.6-2.0	0.08-0.12	6.6-8.4	<2	Moderate	0.17			
	15-23	10-25	0.6-2.0	0.07-0.11	7.4-8.4	<2	Low	0.17			
	23-60	10-20	2.0-6.0	0.06-0.09	7.4-8.4	<2	Low	0.10			
40	0-5	15-27	0.6-2.0	0.16-0.18	7.9-8.4	2-8	Low	0.28	5	4L	1-2
Hagga	5-60	18-35	0.2-0.6	0.14-0.17	7.9-8.4	<2	Moderate	0.24			
41	0-21	15-27	0.6-2.0	0.16-0.20	6.1-8.4	<4	Low	0.37	5	4L	.5-1
Havre	21-60	18-30	0.6-2.0	0.14-0.18	7.4-9.0	<8	Low	0.28			
42	0-5	18-27	0.6-2.0	0.09-0.11	7.4-7.8	<2	Low	0.24	1	6	1-3
Irigul	5-12	18-35	0.6-2.0	0.05-0.10	7.4-7.8	<2	Low	0.24			
	12	---	---	---	---	---	---	---			
43*:											
Irigul	0-5	18-27	0.6-2.0	0.09-0.11	7.4-7.8	<2	Low	0.24	1	6	1-3
	5-12	18-35	0.6-2.0	0.05-0.10	7.4-7.8	<2	Low	0.24			
	12	---	---	---	---	---	---	---			
Parachute	0-4	15-25	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.24	2	8	3-6
	4-24	15-25	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low	0.24			
	24-38	15-25	2.0-6.0	0.03-0.06	6.6-7.8	<2	Low	0.10			
	38	---	---	---	---	---	---	---			
44	0-13	15-35	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low	0.24	5	6	3-5
Jerry	13-60	20-40	0.6-2.0	0.13-0.15	6.6-8.4	<2	Moderate	0.24			
45*:											
Jerry	0-13	15-35	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low	0.24	5	6	3-5
	13-60	20-40	0.6-2.0	0.13-0.15	6.6-8.4	<2	Moderate	0.24			
Thornburgh	0-14	8-20	0.6-2.0	0.12-0.15	6.6-7.8	<2	Low	0.24	5	8	2-4
	14-27	10-20	2.0-6.0	0.08-0.10	6.6-7.8	<2	Low	0.24			
	27-60	10-20	2.0-6.0	0.06-0.08	7.4-7.8	<2	Low	0.24			
Rhone	0-24	20-27	0.6-2.0	0.19-0.21	6.6-7.8	<2	Low	0.24	3	6	3-6
	24-50	20-30	0.6-2.0	0.08-0.10	6.6-7.8	<2	Low	0.20			
	50	---	---	---	---	---	---	---			
46	0-5	15-20	0.6-2.0	0.13-0.15	7.4-8.4	<4	Low	0.20	5	3	<1
Kinnear	5-60	15-27	0.6-2.0	0.14-0.16	7.4-9.0	<4	Low	0.28			
47, 48	0-12	27-40	0.2-0.6	0.16-0.20	6.6-8.4	<2	Moderate	0.37	5	6	.5-1
Kobar	12-60	35-45	0.06-0.2	0.14-0.18	7.9-9.0	<4	High	0.37			
49	0-7	27-40	0.2-0.6	0.16-0.20	6.6-8.4	<2	Moderate	0.37	5	6	.5-1
Kobar	7-60	35-45	0.06-0.2	0.14-0.18	7.9-9.0	<4	High	0.37			
50*:											
Lamphier	0-26	20-27	0.6-2.0	0.18-0.21	6.1-7.3	<2	Low	0.28	5	5	2-4
	26-60	20-35	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	0.32			
Tampico	0-15	18-25	0.6-2.0	0.16-0.18	5.6-7.3	<2	Low	0.37	5	6	---
	15-42	22-30	0.6-2.0	0.13-0.16	6.1-7.3	<2	Low	0.37			
	42-60	28-32	0.6-2.0	0.13-0.15	6.6-7.8	<2	Low	0.32			

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
50*:											
Kamack	0-14	10-20	0.6-2.0	0.15-0.17	6.6-7.3	<2	Low	0.28	2	5	2-4
	14-55	18-28	2.0-6.0	0.08-0.13	6.1-6.5	<2	Low	0.20			
	55	---	---	---	---	---	---	---			
51*:											
Mergel	0-12	15-27	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	0.20	5	5	2-4
	12-60	15-27	0.6-2.0	0.06-0.08	7.9-8.4	<2	Low	0.20			
Redthayne	0-8	15-27	0.6-2.0	0.14-0.18	6.6-7.8	<2	Low	0.28	5	8	1-3
	8-18	18-35	0.6-2.0	0.12-0.16	6.6-8.4	<2	Low	0.32			
	18-60	15-27	0.6-2.0	0.09-0.12	7.4-9.0	<2	Low	0.32			
Dollard	0-3	35-45	0.06-0.2	0.17-0.19	7.4-9.0	<2	High	0.37	2	4L	1-2
	3-26	35-50	0.06-0.2	0.13-0.18	7.4-9.0	<2	High	0.37			
	26	---	---	---	---	---	---	---			
52	0-8	10-20	2.0-6.0	0.12-0.15	6.6-7.3	<2	Low	0.28	3	3	2-4
Miracle	8-27	20-30	0.6-2.0	0.14-0.16	6.6-7.3	<2	Low	0.28			
	27-32	---	---	---	---	---	---	---			
	32	---	---	---	---	---	---	---			
53	0-2	27-35	0.2-0.6	0.14-0.16	7.9-9.0	2-4	Moderate	0.24	1	5	1-2
Moyerson	2-17	35-50	0.06-0.2	0.14-0.17	7.9-9.0	2-4	---	0.28			
54*:											
Nagitsy	0-23	15-27	0.6-2.0	0.08-0.10	5.6-7.3	<2	Low	0.15	2	8	2-5
	23-33	15-27	0.6-2.0	0.07-0.09	5.6-7.3	<2	Low	0.10			
	33	---	---	---	---	---	---	---			
Irigul	0-5	18-27	0.6-2.0	0.09-0.11	7.4-7.8	<2	Low	0.24	1	6	1-3
	5-12	18-35	0.6-2.0	0.05-0.10	7.4-7.8	<2	Low	0.24			
	12	---	---	---	---	---	---	---			
55	0-5	10-15	2.0-6.0	0.10-0.12	7.4-8.4	<2	Low	0.20	2	5	.5-1
Nihill	5-60	15-27	2.0-6.0	0.06-0.09	7.9-9.0	<4	Low	0.20			
56	0-25	20-27	0.6-2.0	0.13-0.18	6.6-7.8	<2	Low	0.32	5	8	3-6
Northwater	25-47	20-35	0.6-2.0	0.08-0.10	6.6-7.8	<2	Low	0.20			
	47	---	---	---	---	---	---	---			
57*:											
Owen Creek	0-5	15-27	0.6-2.0	0.19-0.21	6.6-7.8	<2	Low	0.24	2	---	2-3
	5-24	35-50	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	---			
	24	---	---	---	---	---	---	---			
Jerry	0-13	15-35	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low	0.24	5	6	3-5
	13-60	20-40	0.6-2.0	0.13-0.15	6.6-8.4	<2	Moderate	0.24			
Burnette	0-5	15-27	0.6-2.0	0.16-0.20	6.1-7.3	<2	Low	0.37	5	6	3-6
	5-10	27-40	0.6-2.0	0.14-0.18	6.1-7.3	<2	Moderate	0.32			
	10-30	35-50	0.06-0.2	0.14-0.18	6.6-7.8	<2	High	0.28			
	30-60	35-45	0.06-0.2	0.14-0.18	7.4-8.4	<2	High	0.28			
58	0-4	18-25	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.24	2	8	3-6
Parachute	4-24	18-25	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low	0.24			
	24-38	18-25	2.0-6.0	0.03-0.06	6.6-7.8	<2	Low	0.10			
	38	---	---	---	---	---	---	---			
59*:											
Parachute	0-4	18-25	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low	0.24	2	8	3-6
	4-32	18-25	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low	0.24			
	32-38	18-25	2.0-6.0	0.03-0.06	6.6-7.8	<2	Low	0.10			
	38	---	---	---	---	---	---	---			
Rhone	0-24	20-27	0.6-2.0	0.19-0.21	6.6-7.8	<2	Low	0.24	3	6	3-6
	24-50	20-30	0.6-2.0	0.08-0.10	6.6-7.8	<2	Low	0.20			
	50	---	---	---	---	---	---	---			

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
60, 61, 62	0-10	20-27	0.6-2.0	0.20-0.22	7.4-8.4	<2	Moderate	0.32	5	4L	1-3
Patent	10-60	18-35	0.2-2.0	0.14-0.19	7.9-8.4	<2	Moderate	0.32			
63	0-5	20-27	0.6-2.0	0.20-0.22	7.4-8.4	<2	Moderate	0.32	5	4L	1-3
Patent	5-60	18-30	0.6-2.0	0.14-0.19	7.9-8.4	<2	Moderate	0.32			
64	0-4	12-20	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low	0.20	2	3	1-1
Piceance	4-22	18-30	0.6-2.0	0.15-0.17	7.4-8.4	<2	Moderate	0.32			
	22-30	15-25	0.6-2.0	0.04-0.07	7.9-8.4	<2	Low	0.10			
	30	---	---	---	---	---	---	----			
65	0-3	28-32	0.2-0.6	0.17-0.19	6.6-7.8	2-4	Moderate	0.28	5	6	.5-1
Pinelli	3-31	35-40	0.2-0.6	0.19-0.21	6.6-8.4	2-4	High	0.37			
	31-60	18-35	0.2-0.6	0.19-0.21	7.9-9.0	2-4	Moderate	0.37			
66*:											
Potts	0-3	8-15	2.0-6.0	0.11-0.13	7.4-8.4	<2	Low	0.28	5	3	1-2
	3-17	25-35	0.6-2.0	0.19-0.21	7.4-8.4	<2	Moderate	0.43			
	17-60	15-30	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low	0.55			
Begay	0-9	8-15	2.0-6.0	0.09-0.14	7.4-8.4	<2	Low	0.43	5	3	1-2
	9-30	7-15	2.0-6.0	0.13-0.18	7.4-8.4	<2	Low	0.43			
	30-60	5-12	2.0-6.0	0.10-0.15	7.9-8.4	<2	Low	0.37			
67	0-12	15-25	0.6-2.0	0.15-0.17	7.9-8.4	<2	Low	0.24	5	8	2-4
Rabbitex	12-21	18-25	0.6-2.0	0.10-0.14	7.9-8.4	<2	Low	0.28			
	21-43	15-25	0.6-2.0	0.08-0.14	7.9-9.0	<2	Low	0.28			
	43	---	---	---	---	---	---	----			
68*:											
Rabbitex	0-12	15-25	0.6-2.0	0.16-0.18	7.9-8.4	<2	Low	0.24	5	5	2-4
	12-21	18-25	0.6-2.0	0.10-0.14	7.9-8.4	<2	Low	0.28			
	21-43	15-25	0.6-2.0	0.08-0.14	7.9-9.0	<2	Low	0.28			
	43	---	---	---	---	---	---	----			
Work	0-10	15-27	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.37	5	5	2-4
	10-30	35-45	0.2-0.6	0.13-0.17	6.6-7.8	<2	High	0.32			
	30-60	20-40	0.2-0.6	0.14-0.18	7.4-8.4	<4	Moderate	0.32			
69	0-35	12-18	2.0-6.0	0.10-0.13	7.9-8.4	<2	Low	0.20	5	8	2-4
Razorba	35-60	12-18	2.0-6.0	0.07-0.09	7.9-8.4	<2	Low	0.17			
70*:											
Redcreek	0-11	5-15	2.0-6.0	0.12-0.16	7.4-8.4	<2	Low	0.43	1	3	.5-1
	11-16	5-15	2.0-6.0	0.09-0.11	7.9-8.4	<2	Low	0.15			
	16	---	---	---	---	---	---	----			
Rentsac	0-5	7-18	2.0-6.0	0.12-0.16	6.6-8.4	<2	Low	0.32	1	5	.5-2
	5-16	7-18	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low	0.28			
	16	---	---	---	---	---	---	----			
71	0-17	18-27	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	0.32	5	5	2-4
Redrob	17-35	18-27	2.0-6.0	0.10-0.15	7.4-8.4	<2	Low	0.32			
	35-60	2-8	>20.0	0.03-0.05	6.6-7.8	<2	Low	0.10			
72	0-15	18-27	0.6-2.0	0.18-0.21	6.1-7.3	<2	Low	0.28	3	8	1-3
Redrob Variant	15-60	0-5	>20.	0.03-0.05	6.6-7.3	<2	Low	0.02			
73	0-5	7-18	2.0-6.0	0.12-0.16	6.6-8.4	<2	Low	0.32	1	5	.5-2
Rentsac	5-16	7-18	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low	0.28			
	16	---	---	---	---	---	---	----			
74*:											
Rentsac	0-5	7-18	2.0-6.0	0.12-0.16	6.6-8.4	<2	Low	0.32	1	5	.5-2
	5-16	7-18	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low	0.28			
	16	---	---	---	---	---	---	----			

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
74*:											
Moyerson	0-2	30-40	0.2-0.6	0.14-0.17	7.4-9.0	<2	Moderate	0.28	1	8	<1
	2-17	35-50	0.06-0.2	0.12-0.16	7.4-9.0	<2	High	0.28			
	17	---	---	---	---	---	---	---			
Rock outcrop.											
75*:											
Rentsac	0-5	7-18	2.0-6.0	0.12-0.16	6.6-8.4	<2	Low	0.32	1	5	.5-2
	5-16	7-18	2.0-6.0	0.06-0.10	7.4-8.4	<4	Low	0.28			
	16	---	---	---	---	---	---	---			
Piceance	0-4	12-20	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low	0.20	2	3	1-1
	4-22	18-30	0.6-2.0	0.15-0.17	7.4-8.4	<2	Moderate	0.32			
	22-30	15-25	0.6-2.0	0.04-0.07	7.9-8.4	<2	Low	0.10			
	30	---	---	---	---	---	---	---			
76	0-24	20-27	0.6-2.0	0.19-0.21	6.6-7.8	<2	Low	0.24	3	6	3-6
Rhone	24-50	20-30	0.6-2.0	0.08-0.10	6.6-7.8	<2	Low	0.20			
	50	---	---	---	---	---	---	---			
77*:											
Rhone	0-24	20-27	0.6-2.0	0.19-0.21	6.6-7.8	<2	Low	0.24	3	6	3-6
	24-50	20-30	0.6-2.0	0.08-0.10	6.6-7.8	<2	Low	0.20			
	50	---	---	---	---	---	---	---			
Northwater	0-26	20-27	0.6-2.0	0.13-0.18	6.6-7.8	<2	Low	0.32	5	8	3-6
	26-48	20-35	0.6-2.0	0.08-0.10	6.6-7.8	<2	Low	0.20			
	48	---	---	---	---	---	---	---			
Lamphier	0-18	20-27	0.6-2.0	0.18-0.21	6.1-7.3	<2	Low	0.28	5	5	2-4
	18-60	20-35	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	0.32			
78*.											
Rock outcrop											
79, 80	0-16	20-27	0.6-2.0	0.14-0.16	6.6-7.8	<2	Moderate	0.24	5	5	2-4
Shawa	16-60	18-30	0.6-2.0	0.14-0.16	6.6-8.4	<2	Moderate	0.24			
81	0-8	20-27	0.6-2.0	0.16-0.18	6.6-7.8	2-8	Low	0.24	5	8	3-6
Shawa	8-28	18-30	0.6-2.0	0.16-0.18	6.6-8.4	2-8	Low	0.32			
	28-60	18-30	0.6-2.0	0.15-0.18	6.6-9.0	2-8	Low	0.32			
82, 83	0-24	15-25	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low	0.32	5	6	1-3
Silas	24-60	18-35	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low	0.32			
84	0-20	20-27	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low	0.24	5	5	2-6
Silas Variant	20-60	20-35	0.2-0.6	0.17-0.21	7.4-8.4	<2	Moderate	----			
85, 86	0-3	18-35	0.6-2.0	0.16-0.18	7.9-8.4	<4	Moderate	0.55	---	---	---
Sinkson	3-60	18-27	0.6-2.0	0.14-0.16	7.9-8.4	<4	Low	0.20			
87*:											
Starman	0-2	15-23	0.6-2.0	0.09-0.11	7.9-9.0	<2	Low	0.24	1	4L	1-2
	2-17	20-27	0.6-2.0	0.09-0.11	7.9-9.0	<2	Low	0.28			
	17	---	---	---	---	---	---	---			
Vandamore	0-4	15-25	0.6-2.0	0.12-0.14	7.4-8.4	<2	Low	0.20	1	8	1-2
	4-25	18-25	2.0-6.0	0.06-0.08	7.4-8.4	<2	Low	0.20			
	25	---	---	---	---	---	---	---			
88*:											
Tampico	0-15	18-25	0.6-2.0	0.16-0.18	5.6-7.3	<2	Low	0.37	5	6	---
	15-42	22-30	0.6-2.0	0.13-0.16	6.1-7.3	<2	Low	0.37			
	42-60	28-32	0.6-2.0	0.13-0.15	6.6-7.8	<2	Low	0.32			

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
88*:											
Miracle	0-8	10-20	2.0-6.0	0.12-0.15	6.6-7.3	<2	Low	0.28	3	3	2-4
	8-27	20-30	0.6-2.0	0.14-0.16	6.6-7.3	<2	Low	0.28			
	27-32	---	---	---	---	---	---	---			
	32	---	---	---	---	---	---	---			
89	0-4	10-18	2.0-6.0	0.05-0.07	>7.8	>4	Low	0.32	5	3	1-2
Tisworth	4-11	18-35	0.06-0.2	0.07-0.11	>8.4	>4	Moderate	0.49			
	11-60	5-20	0.6-6.0	0.07-0.10	>8.4	>4	Low	0.32			
90*.											
Torrifluvents											
91*:											
Torriorthents.											
Rock outcrop.											
92	0-8	5-15	2.0-6.0	0.12-0.16	6.6-7.8	<2	Low	0.20	5	3	---
Trembles	8-60	8-15	2.0-6.0	0.11-0.15	7.4-8.4	<2	Low	0.20			
93, 94	0-4	15-20	2.0-6.0	0.13-0.15	7.4-9.0	2-4	Low	0.28	5	3	.5-.6
Turley	4-60	18-35	0.2-0.6	0.18-0.20	7.4-9.0	2-4	Moderate	0.37			
95	0-2	15-25	0.6-2.0	0.13-0.16	>7.3	4-8	Low	0.28	1	6	.5-1
Uffens	2-19	27-35	0.2-0.6	0.05-0.10	>8.4	>16	Moderate	0.32			
	19-60	20-30	0.2-0.6	0.05-0.10	>7.8	>16	Moderate	0.28			
96	0-8	10-20	0.6-2.0	0.14-0.16	7.4-8.4	<2	Low	0.28	2	8	---
Veatch	8-18	10-20	0.6-2.0	0.13-0.15	7.9-8.4	<2	Low	0.28			
	18-32	15-20	2.0-6.0	0.06-0.08	7.9-9.0	<2	Low	0.17			
	32	---	---	---	---	---	---	---			
97	0-4	12-20	2.0-6.0	0.09-0.12	7.9-9.0	<2	Low	0.20	1	8	.5-1
Walknolls	4-12	18-27	2.0-6.0	0.05-0.09	7.9-9.0	<2	Low	0.24			
	12	---	---	---	---	---	---	---			
98*:											
Waybe	0-4	27-40	0.2-0.6	0.12-0.16	7.4-8.4	<4	Moderate	0.32	1	4L	---
	4-19	35-45	0.06-0.2	0.14-0.18	7.9-8.4	<4	Moderate	0.37			
	19	---	---	---	---	---	---	---			
Vandamore Variant	0-5	15-25	0.6-2.0	0.12-0.15	7.4-7.8	<2	Low	0.10	1	8	<1
	5-33	10-30	2.0-6.0	0.10-0.14	7.4-8.4	<2	Low	0.10			
	33	---	---	---	---	---	---	---			
Rock outcrop.											
99*:											
Winnemucca	0-16	18-27	0.6-2.0	0.16-0.18	6.1-7.3	<2	Low	0.28	2	5	2-5
	16-60	35-45	0.06-0.2	0.08-0.12	6.1-7.3	<2	Moderate	0.17			
Clayburn	0-14	15-25	0.6-2.0	0.16-0.18	6.1-7.3	<2	Low	0.20	4	5	2-5
	14-60	20-35	0.6-2.0	0.14-0.16	6.1-7.8	<2	Moderate	0.28			
100, 101, 102	0-10	15-27	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.37	5	5	2-4
Work	10-30	35-45	0.2-0.6	0.13-0.17	6.6-7.8	<2	High	0.32			
	30-60	15-40	0.2-0.6	0.12-0.16	7.4-8.4	<4	Moderate	0.28			
103	0-4	15-27	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.37	5	5	2-4
Work	4-25	35-45	0.2-0.6	0.13-0.17	6.6-7.8	<2	High	0.32			
	25-60	20-40	0.2-0.6	0.14-0.18	7.4-8.4	<4	Moderate	0.32			
104	0-4	18-27	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low	0.37	5	5	1-2
Yamac	4-22	18-30	0.6-2.0	0.14-0.18	6.6-8.4	<2	Moderate	0.37			
	22-60	18-30	0.6-2.0	0.14-0.18	7.9-9.0	<4	Moderate	0.37			

See footnote at end of table.

TABLE 10.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
105, 106, 107---- Zoltay	0-13	28-35	0.2-0.6	0.17-0.19	6.6-7.8	<2	Moderate	0.24	5	6	3-6
	13-31	35-45	0.06-0.2	0.13-0.15	6.6-8.4	<2	High------	0.24			
	31-60	25-40	0.2-0.6	0.10-0.12	7.4-8.4	<2	Moderate	0.17			
108---------- Zoltay	0-9	28-35	0.2-0.6	0.17-0.19	6.6-7.8	<2	Moderate	0.24	5	6	3-6
	9-27	35-45	0.2-0.6	0.13-0.15	6.6-8.4	<2	High------	0.24			
	27-60	25-40	0.2-0.6	0.10-0.12	7.4-8.4	<2	Moderate	0.17			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
1---- Abor	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
2*:												
Absarokee	C	None	---	---	>6.0	---	---	20-40	Hard	Low	High	Low.
Delson	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
3, 4---- Absher	D	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
5*. Badland												
6---- Barcus	A	Rare	---	---	>6.0	---	---	>60	---	Low	High	Low.
7---- Billings	C	None	---	---	>6.0	---	---	>60	---	High	High	High.
8*:												
Billings	C	None	---	---	>6.0	---	---	>60	---	High	High	High.
Torrifluvents.												
9*:												
Blakabin	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Rhone	B	None	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
Waybe	D	None	---	---	>6.0	---	---	10-20	Soft	Moderate	High	Low.
10*:												
Blazon	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	Low.
Rentsac	C	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
11*: Borollic Calciorthids.												
Guben	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.

See footnote at end of table.

TABLE 11.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
12*:												
Bucklon	D	None	---	---	>6.0	---	---	10-20	Soft	Moderate	High	Low.
Inchau	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
13--Bulkley	C	None	---	---	>6.0	---	---	40-60	Soft	Low	High	High.
14*:												
Bulkley	C	None	---	---	>6.0	---	---	40-60	Soft	Low	High	High.
Abor	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
15--Castner	C	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
16, 17--Chipeta	D	None	---	---	>6.0	---	---	14-20	Soft	Moderate	High	High.
18*:												
Chipeta	D	None	---	---	>6.0	---	---	14-20	Soft	Moderate	High	High.
Killpack	C	None	---	---	>6.0	---	---	20-40	Soft	High	High	High.
19*:												
Chipeta	D	None	---	---	>6.0	---	---	14-20	Soft	Moderate	High	High.
Walknolls	D	None	---	---	>6.0	---	---	10-20	Hard	Low	High	Low.
20--Clayburn	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
21*:												
Cliffdown	B	None	---	---	>6.0	---	---	>60	---	Low	High	High.
Cliffdown Variant	D	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Moderate.
22--Clifterson	B	None	---	---	>6.0	---	---	>60	---	Low	High	Moderate.
23--Cochetopa	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
24*:												
Cochetopa	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Jerry	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.

See footnote at end of table.

TABLE 11.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
25--Colorow	B	Rare	---	---	4.0-6.0	Apparent	Apr-Jun	>60	---	Low	High	Low.
26*:												
Cowdrey	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Tampico	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
27--Curecanti	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
28*:												
Delson	C	None	---	---	>6.0	---	---	>60	---	Low	Moderate	Low.
Perma	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
29, 30, 31--Dollard	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
32*. Fluvaquents.												
33, 34--Forelle	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
35*:												
Gaynor	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	High.
Midway	D	None	---	---	>6.0	---	---	8-20	Soft	Low	High	High.
36--Glendive	B	Rare	---	---	>6.0	---	---	>60	---	Low	High	Low.
37--Glenton	B	Occasional	Very brief	Apr-Jun	>6.0	---	---	>60	---	Low	High	Low.
38, 39--Guben	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
40--Hagga	B/D	Rare	---	---	1.0-2.0	Apparent	May-Jul	>60	---	High	High	Low.
41--Havre	B	Rare	---	---	>6.0	---	---	>60	---	Low	High	Low.
42--Irigul	D	None	---	---	>6.0	---	---	10-20	Hard	Low	High	Low.

See footnote at end of table.

TABLE 11.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
43*:												
Irigul	D	None	---	---	>6.0	---	---	10-20	Hard	Low	High	Low.
Parachute	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Moderate	Low.
44--Jerry	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
45*:												
Jerry	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Thornburgh	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Rhone	B	None	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
46--Kinnear	B	None	---	---	>6.0	---	---	>60	---	Low	High	High.
47, 48, 49--Kobar	C	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
50*:												
Lamphier	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Tampico	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Kamack	B	None	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Moderate.
51*:												
Mergel	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Redthayne	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Dollard	C	None	---	---	>6.0	---	---	20-40	Soft	Low	High	Low.
52--Miracle	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Low.
53--Moyerson	D	None	---	---	>6.0	---	---	10-20	Soft	Low	High	High.
54*:												
Nagitsy	C	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High	Low.
Irigul	D	None	---	---	>6.0	---	---	5-20	Hard	Low	High	Low.
55--Nihill	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.

See footnote at end of table.

TABLE 11.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
56---------- Northwater	B	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Low.
57*:												
Owen Creek-------	C	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Low.
Jerry----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Burnette---------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
58---------- Parachute	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Low.
59*:												
Parachute--------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Low.
Rhone----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
60, 61, 62, 63---- Patent	C	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
64---------- Piceance	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	High-----	Low.
65---------- Pinelli	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
66*:												
Potts----------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
Begay----------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Moderate.
67---------- Rabbitex	B	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	High-----	Low.
68*:												
Rabbitex---------	B	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	High-----	Low.
Work----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
69---------- Razorba	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
70*:												
Redcreek---------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	High-----	Low.
Rentsac----------	C	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	Low.

See footnote at end of table.

TABLE 11.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
71---------- Redrob	D	Rare--------	---	---	1.5-4.0	Apparent	Jan-Dec	>60	---	Low------	High-----	Low.
72---------- Redrob Variant	B	Rare--------	---	---	2.0-4.0	Apparent	Jan-Dec	>60	---	Low------	Low------	Low.
73---------- Rentsac	C	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	Low.
74*:												
Rentsac----------	C	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	Low.
Moyerson---------	D	None--------	---	---	>6.0	---	---	10-20	Soft	Low------	High-----	High.
Rock outcrop.												
75*:												
Rentsac----------	C	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	High-----	Low.
Piceance---------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	High-----	Low.
76---------- Rhone	B	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Low.
77*:												
Rhone----------	B	None--------	---	---	>6.0	---	---	40-60	Soft	Moderate	Moderate	Low.
Northwater-------	B	None--------	---	---	>6.0	---	---	40-60	Hard	Moderate	Moderate	Low.
Lamphier---------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
78*. Rock outcrop												
79, 80---------- Shawa	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
81---------- Shawa	B	Occasional	Brief-----	May-Jul	2.0-4.0	Apparent	Apr-Aug	>60	---	High-----	Moderate	Low.
82, 83---------- Silas	B	None--------	---	---	4.0-6.0	Apparent	Apr-Jul	>60	---	Moderate	High-----	Low.
84---------- Silas Variant	B	Rare--------	---	---	3.5-6.0	Apparent	Apr-Jun	>60	---	Moderate	High-----	Low.
85, 86---------- Sinkson	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	High.

See footnote at end of table.

TABLE 11.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
87*:												
Starman	D	None	---	---	>6.0	---	---	10-20	Hard	Moderate	High	Low.
Vandamore	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Low.
88*:												
Tampico	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
Miracle	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Low.
89---------- Tisworth	C	None	---	---	>6.0	---	---	>60	---	Low	High	High.
90*. Torrifluvents												
91*: Torriorthents.												
Rock outcrop.												
92---------- Trembles	B	Occasional	Brief	Apr-Jun	3.0-5.0	Apparent	Apr-May	>60	---	Moderate	High	Low.
93, 94---------- Turley	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
95---------- Uffens	B	None	---	---	>6.0	---	---	>60	---	Low	High	High.
96---------- Veatch	B	None	---	---	>6.0	---	---	20-40	Hard	Low	High	Low.
97---------- Walknolls	D	None	---	---	>6.0	---	---	10-20	Hard	Low	High	Low.
98*:												
Waybe	D	None	---	---	>6.0	---	---	10-20	Soft	Moderate	High	Low.
Vandamore Variant	B	None	---	---	>6.0	---	---	20-40	Soft	Low	Moderate	Low.
Rock outcrop.												
99*:												
Winnemucca	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Clayburn	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.

See footnote at end of table.

TABLE 11.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
100, 101, 102, 103---------- Work	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
104---------- Yamac	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
105, 106, 107, 108---------- Zoltay	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Abor	Fine, montmorillonitic, frigid Udorthentic Chromusterts
Absarokee	Fine, montmorillonitic Typic Argiborolls
Absher	Fine, montmorillonitic Borollic Natrargids
Barcus	Sandy-skeletal, mixed, frigid Ustic Torrifluvents
Begay	Coarse-loamy, mixed, mesic Ustollic Camborthids
Billings	Fine-silty, mixed (calcareous), mesic Typic Torrifluvents
Blakabin	Fine, montmorillonitic Typic Cryoborolls
Blazon	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents
Bucklon	Loamy, mixed, shallow Typic Cryoborolls
Bulkley	Fine, montmorillonitic, frigid Udorthentic Chromusterts
Burnette	Fine, montmorillonitic Argic Pachic Cryoborolls
Castner	Loamy-skeletal, mixed Lithic Haploborolls
Chipeta	Clayey, mixed (calcareous), mesic, shallow Typic Torriorthents
Clayburn	Fine-loamy, mixed Argic Pachic Cryoborolls
Cliffdown	Loamy-skeletal, mixed (calcareous), mesic Typic Torriorthents
Cliffdown Variant	Fine-loamy, mixed (calcareous), mesic Typic Torriorthents
Clifterson	Loamy-skeletal, mixed (calcareous), mesic Typic Torriorthents
Cochetopa	Fine, montmorillonitic Argic Pachic Cryoborolls
Colorow	Coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents
Cowdrey	Fine, montmorillonitic Typic Cryoboralfs
Curecanti	Loamy-skeletal, mixed Aridic Argiborolls
Delson	Fine, montmorillonitic Typic Argiborolls
Dollard	Fine, montmorillonitic (calcareous), frigid Ustic Torriorthents
Forelle	Fine-loamy, mixed Borollic Haplargids
Gaynor	Fine, montmorillonitic (calcareous), mesic Ustic Torriorthents
Glendive	Coarse-loamy, mixed (calcareous), frigid Ustic Torrifluvents
Glenton	Coarse-loamy, mixed (calcareous), mesic Typic Torrifluvents
Guben	Loamy-skeletal, mixed Typic Calciborolls
Hagga	Fine-loamy, mixed (calcareous), frigid Typic Fluvaquents
Havre	Fine-loamy, mixed (calcareous), frigid Ustic Torrifluvents
Inchau	Fine-loamy, mixed Argic Cryoborolls
Irigul	Loamy-skeletal, mixed Lithic Cryoborolls
Jerry	Fine, montmorillonitic Argic Cryoborolls
Kamack	Loamy-skeletal, mixed Typic Cryoborolls
Killpack	Fine-silty, mixed (calcareous), mesic Typic Torriorthents
Kinnear	Fine-loamy, mixed, mesic Typic Camborthids
Kobar	Fine, montmorillonitic Borollic Camborthids
Lamphier	Fine-loamy, mixed Pachic Cryoborolls
Mergel	Loamy-skeletal, mixed Torriorthentic Haploborolls
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Miracle	Fine-loamy, mixed Argic Cryoborolls
Moyerson	Clayey, montmorillonitic (calcareous), frigid, shallow Ustic Torriorthents
Nagitsy	Loamy-skeletal, mixed Pachic Cryoborolls
Nihill	Loamy-skeletal, mixed (calcareous), mesic Ustic Torriorthents
Northwater	Loamy-skeletal, mixed Cryic Pachic Paleborolls
Owen Creek	Fine, montmorillonitic Argic Cryoborolls
Parachute	Loamy-skeletal, mixed Typic Cryoborolls
Patent	Fine-loamy, mixed (calcareous), frigid Ustic Torriorthents
Perma	Loamy-skeletal, mixed Typic Haploborolls
Piceance	Fine-loamy, mixed Borollic Camborthids
Pinelli	Fine, montmorillonitic Borollic Haplargids
Potts	Fine-loamy, mixed, mesic Ustollic Haplargids
Rabbitex	Fine-loamy, mixed Typic Calciborolls
Razorba	Coarse-loamy, mixed Pachic Cryoborolls
Redcreek	Loamy, mixed (calcareous), frigid Lithic Ustic Torriorthents
Redrob	Fine-loamy over sandy or sandy-skeletal, mixed (calcareous), frigid Fluvaquentic Haplaquolls
Redrob Variant	Fine-loamy over sandy or sandy-skeletal, mixed Typic Cryaquolls
Redthayne	Loamy-skeletal, mixed Aridic Haploborolls
Rentsac	Loamy-skeletal, mixed (calcareous), frigid Lithic Ustic Torriorthents
Rhone	Fine-loamy, mixed Pachic Cryoborolls
Shawa	Fine-loamy, mixed Pachic Haploborolls
Silas	Fine-loamy, mixed Cumulic Cryoborolls
Silas Variant	Fine-loamy, mixed Cumulic Haploborolls
Sinkson	Fine-loamy, mixed (calcareous), frigid Ustic Torriorthents
Starman	Loamy-skeletal, mixed (calcareous) Lithic Cryorthents
Tampico	Fine-loamy, mixed Typic Cryoborolls
Thornburgh	Loamy-skeletal, mixed Typic Cryoborolls
Tisworth	Fine-loamy, mixed Borollic Natrargids
Trembles	Coarse-loamy, mixed (calcareous), frigid Typic Ustifluvents

TABLE 12.--CLASSIFICATION OF THE SOILS--Continued

Soil name	Family or higher taxonomic class
Turley	Fine-loamy, mixed (calcareous), mesic Typic Torriorthents
Uffens	Fine-loamy, mixed, mesic Typic Natrargids
Vandamore	Loamy-skeletal, mixed (calcareous) Typic Cryorthents
Vandamore Variant	Loamy-skeletal, mixed (calcareous) Typic Cryorthents
Veatch	Loamy-skeletal, mixed Typic Haploborolls
Walknolls	Loamy-skeletal, mixed (calcareous), mesic Lithic Torriorthents
Waybe	Clayey, mixed (calcareous), shallow Typic Cryorthents
Winnemucca	Clayey-skeletal, montmorillonitic Argic Pachic Cryoborolls
Work	Fine, montmorillonitic Typic Argiborolls
Yamac	Fine-loamy, mixed Borollic Camborthids
Zoltay	Fine, montmorillonitic Pachic Argiborolls

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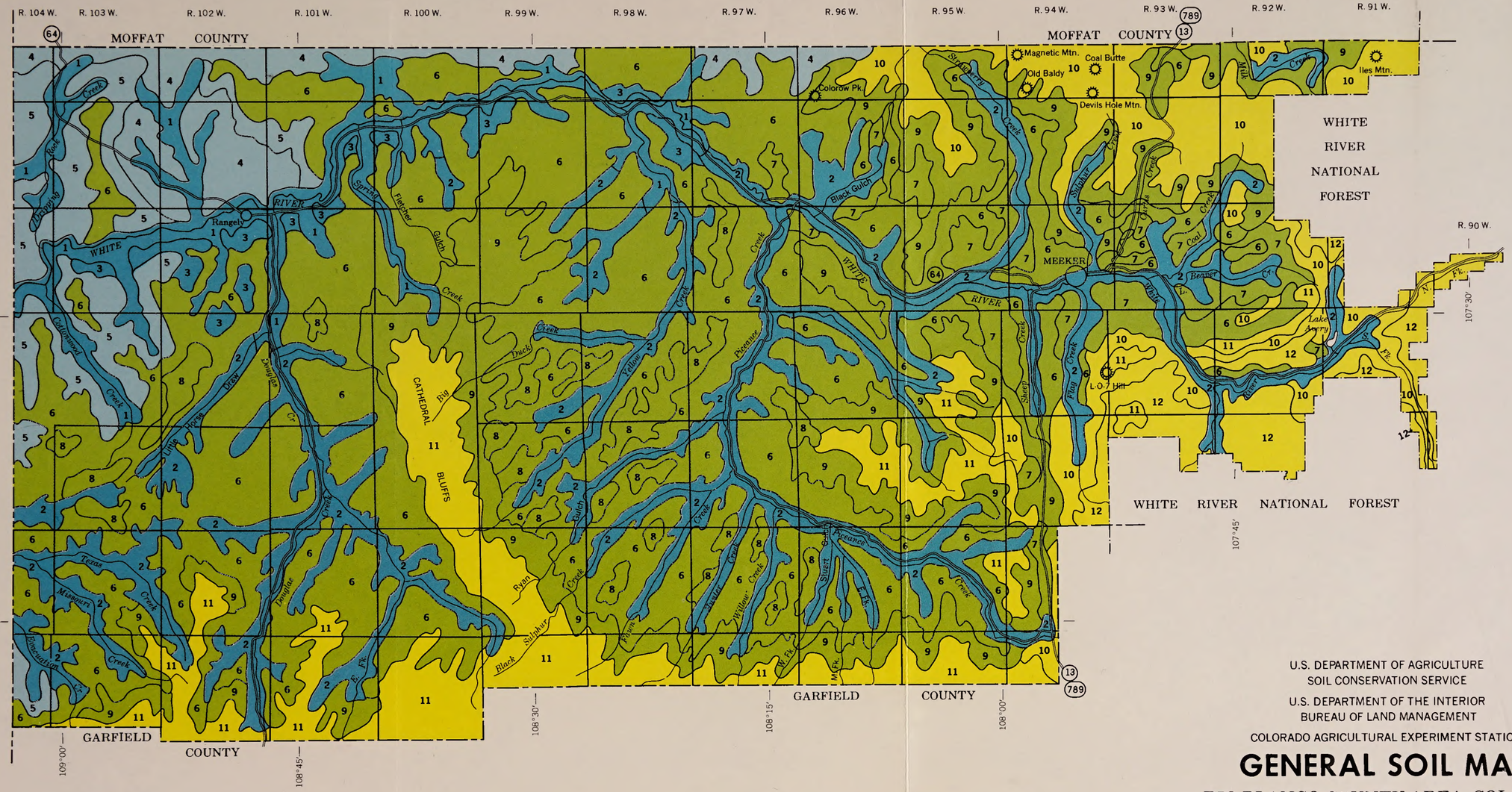

MAP UNITS

SOILS ON FLOOD PLAINS, STREAM TERRACES, ALLUVIAL VALLEY FLOORS, FANS, AND VALLEY SIDE SLOPES

1. Billings-Uffens-Colorow: Deep, well drained and moderately well drained, nearly level to sloping soils
2. Glendive-Kobar-Havre: Deep, well drained, nearly level to moderately steep soils
3. Turley-Cliffdown-Kinnear: Deep, well drained and somewhat excessively drained, nearly level to sloping soils

SOIL ON UPLANDS AND DESERT FOOTHILLS

4. Chipeta-Killpack: Shallow and moderately deep, well drained, gently sloping to steep soils
5. Wallknolls-Pott-Gaynor: Shallow to deep, well drained, gently sloping to steep soils

SOILS ON FOOTHILLS

6. Rentsac-Moyerson-Rock outcrop: Shallow, well drained, gently sloping to very steep soils, and Rock outcrop
7. Forelle-Zoltay-Work: Deep, well drained, gently sloping to hilly soils
8. Piceance-Yamac-Rentsac: Shallow to deep, well drained, gently sloping to hilly soils
9. Castner-Veatch-Redcreek: Shallow and moderately deep, well drained, sloping to very steep soils

SOILS ON MOUNTAINS

10. Jerry-Thornburgh-Owen Creek: Moderately deep and deep, well drained, sloping to very steep soils
11. Irigul-Parachute-Rhone: Shallow to deep, well drained, gently sloping to very steep soils
12. Miracle-Tampico-Winnemucca: Moderately deep and deep, well drained, gently sloping to very steep soils

Compiled 1981

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

COLORADO AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

RIO BLANCO COUNTY AREA, COLORADO

Scale 1: 380,160
1 0 1 2 3 4 5 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

INDEX TO MAP SHEETS

RIO BLANCO COUNTY AREA, COLORADO

Scale 1: 380,160

1 0 1 2 3 4 5 Miles

* QUADRANGLE NAME

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

RIO BLANCO COUNTY AREA, COLORADO

COLORADO AGRICULTURAL EXPERIMENT STATION

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

SOIL LEGEND

SYMBOL	NAME
1	Abor clay loam, 5 to 30 percent slopes
2	Absarokee-Delson channery loam, 8 to 65 percent slopes
3	Absher loam, 0 to 3 percent slopes
4	Absher loam, 3 to 8 percent slopes
5	Badland
6	Barcus channery loamy sand, 2 to 8 percent slopes
7	Billings silty clay loam, 0 to 5 percent slopes
8	Billings-Torrifluvents complex, gullied, 0 to 5 percent slopes
9	Blakabin-Rhone-Waybe complex, 5 to 50 percent slopes
10	Blazon, moist-Rentsac complex, 8 to 65 percent slopes
11	Borollic Calciorthids-Guben complex, 6 to 50 percent slopes
12	Bucklon-Inchau loams, 25 to 50 percent slopes
13	Bulkley channery silty clay loam, 5 to 30 percent slopes
14	Bulkley-Abor clay loam, 5 to 30 percent slopes
15	Castner channery loam, 5 to 50 percent slopes
16	Chipeta silty clay loam, 3 to 25 percent slopes
17	Chipeta silty clay loam, 3 to 25 percent slopes, eroded
18	Chipeta-Killpack silty clay loams, 3 to 15 percent slopes
19	Chipeta-Walknolls complex, 5 to 15 percent slopes
20	Clayburn loam, 3 to 15 percent slopes
21	Cliffdown-Cliffdown Variant complex, 5 to 65 percent slopes
22	Clifterson channery loam, 1 to 15 percent slopes
23	Cochetopa loam, 9 to 50 percent slopes
24	Cochetopa-Jerry loams, 12 to 25 percent slopes
25	Colorow sandy loam
26	Cowdrey-Tampico loams, 15 to 50 percent slopes
27	Curecanti very cobbly loam, 1 to 8 percent slopes
28	Delson-Perma complex, 3 to 65 percent slopes
29	Dollard silty clay loam, 3 to 8 percent slopes
30	Dollard silty clay loam, 8 to 15 percent slopes
31	Dollard silty clay loam, 15 to 40 percent slopes
32	Fluvaquents, frequently flooded*
33	Forelle loam, 3 to 8 percent slopes
34	Forelle loam, 8 to 15 percent slopes
35	Gaynor-Midway silty clay loams, dry, 2 to 25 percent slopes
36	Glendive fine sandy loam
37	Glenton sandy loam, 1 to 6 percent slopes
38	Guben loam, 0 to 3 percent slopes
39	Guben loam, 3 to 8 percent slopes
40	Hagga loam
41	Havre loam, 0 to 4 percent slopes
42	Irigul channery loam, 5 to 50 percent slopes
43	Irigul-Parachute complex, 5 to 30 percent slopes
44	Jerry loam, 12 to 45 percent slopes
45	Jerry-Thornburgh-Rhone complex, 8 to 65 percent slopes
46	Kinnear fine sandy loam, 1 to 5 percent slopes
47	Kobar silty clay loam, 0 to 3 percent slopes
48	Kobar silty clay loam, 3 to 8 percent slopes
49	Kobar silty clay loam, 8 to 15 percent slopes
50	Lamphier-Tampico-Kamack loams, 5 to 60 percent slopes
51	Mergel-Redthayne-Dollard complex, 8 to 65 percent slopes
52	Miracle fine sandy loam, 3 to 25 percent slopes
53	Moyerson stony clay loam, 15 to 65 percent slopes
54	Nagitsy-Irigul channery loams, 5 to 50 percent slopes
55	Nihill channery sandy loam, 5 to 50 percent slopes
56	Northwater loam, 5 to 50 percent slopes
57	Owen Creek-Jerry-Burnette loams, 5 to 35 percent slopes
58	Parachute loam, 25 to 75 percent slopes
59	Parachute-Rhone loams, 5 to 30 percent slopes
60	Patent loam, 0 to 3 percent slopes
61	Patent loam, 3 to 8 percent slopes
62	Patent loam, 8 to 15 percent slopes
63	Patent loam, 15 to 25 percent slopes
64	Piceance fine sandy loam, 5 to 15 percent slopes
65	Pinelli clay loam, 3 to 12 percent slopes
66	Potts-Begay fine sandy loams, 2 to 7 percent slopes
67	Rabbitex flaggy loam, 10 to 65 percent slopes
68	Rabbitex-Work loams, 10 to 25 percent slopes
69	Razorba channery sandy loam, 30 to 75 percent slopes
70	Redcreek-Rentsac complex, 5 to 30 percent slopes
71	Redrob loam
72	Redrob Variant loam
73	Rentsac channery loam, 5 to 50 percent slopes
74	Rentsac-Moyerson-Rock outcrop complex, 5 to 65 percent slopes
75	Rentsac-Piceance complex, 2 to 30 percent slopes
76	Rhone loam, 30 to 75 percent slopes
77	Rhone-Northwater-Lamphier loams, 3 to 50 percent slopes
78	Rock outcrop
79	Shawa loam, 1 to 3 percent slopes
80	Shawa loam, 3 to 8 percent slopes
81	Shawa loam, wet, 0 to 5 percent slopes
82	Silas loam, 0 to 8 percent slopes
83	Silas loam, 8 to 12 percent slopes
84	Silas Variant loam
85	Sinkson gravelly sandy loam, 1 to 8 percent slopes
86	Sinkson gravelly sandy loam, 8 to 15 percent slopes
87	Starman-Vandamore complex, 5 to 40 percent slopes
88	Tampico-Miracle complex, 8 to 50 percent slopes
89	Tisworth fine sandy loam, 0 to 5 percent slopes
90	Torrifluvents, gullied*
92	Trembles loam, wet
93	Turley fine sandy loam, 0 to 3 percent slopes
94	Turley fine sandy loam, 3 to 8 percent slopes
95	Uffens loam, 0 to 5 percent slopes
96	Veatch channery loam, 12 to 50 percent slopes
97	Walknolls channery sandy loam, 5 to 50 percent slopes
98	Waybe-Vandamore Variant-Rock outcrop complex, 5 to 30 percent slopes
99	Winnemucca-Clayburn loams, 8 to 25 percent slopes
100	Work loam, 1 to 3 percent slopes
101	Work loam, 3 to 8 percent slopes
102	Work loam, 8 to 15 percent slopes
103	Work loam, 15 to 25 percent slopes
104	Yamac loam, 2 to 15 percent slopes
105	Zoltay clay loam, 1 to 3 percent slopes
106	Zoltay clay loam, 3 to 8 percent slopes
107	Zoltay clay loam, 8 to 15 percent slopes
108	Zoltay clay loam, 15 to 25 percent slopes

* Broadly defined units

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (70)
- Federal (40)
- State (57)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit (G.P.)
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (SvE 107)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot